

Vol. XIV

No. 3

DISSERTATION

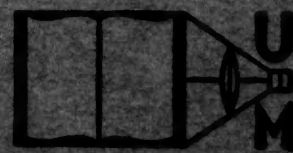
ABSTRACTS

(formerly MICROFILM ABSTRACTS)

*A GUIDE TO DISSERTATIONS AND
MONOGRAPHS AVAILABLE IN MICROFORM*

\$6.00 PER YEAR

\$1.50 SINGLE COPIES



DOCTORAL DISSERTATION SERIES

Cooperating Institutions

University of Arizona	University of Nebraska
University of Arkansas	University of New Mexico
Bradley University	New York University
Brown University	Northwestern University
Bryn Mawr College	University of Notre Dame
University of Buffalo	University of Pennsylvania
Clark University	Pennsylvania State College
Colorado State College of Education	University of Pittsburgh
Columbia University	Princeton University
University of Connecticut	Purdue University
Cornell University	Rutgers University
University of Florida	St. Louis University
Florida State University	University of South Carolina
University of Illinois (including Chicago Professional Colleges)	Stanford University
Indiana University (including the Graduate Schools of Education and Music)	Syracuse University
State University of Iowa	Vanderbilt University
University of Kansas	University of Virginia
Lehigh University	Virginia Polytechnic Institute
University of Michigan	Washington University
Michigan State College	University of Washington
University of Minnesota	Wayne University
University of Missouri	Yale University
	Yeshiva University

Vol. XIV

No. 3

DISSERTATION ABSTRACTS

(formerly MICROFILM ABSTRACTS)

*A GUIDE TO DISSERTATIONS AND
MONOGRAPHS AVAILABLE IN MICROFORM*

UNIVERSITY MICROFILMS
ANN ARBOR, MICHIGAN: 1954

LITHOPRINTED IN THE UNITED STATES OF AMERICA BY
CUSHING - MALLOY, INC., ANN ARBOR, MICHIGAN, 1954

INTRODUCTION

DISSERTATION ABSTRACTS is a vital link in the process of publishing doctoral dissertations, since it makes possible the widespread distribution of information concerning the dissertations which are published in their entirety on microfilm, microcards, or microprint.

The degree to which graduate schools in America make use of this publication service, determines the value of DISSERTATION ABSTRACTS as a bibliographical tool. For its fullest use an understanding of the publication procedure is necessary. Briefly this is as follows:

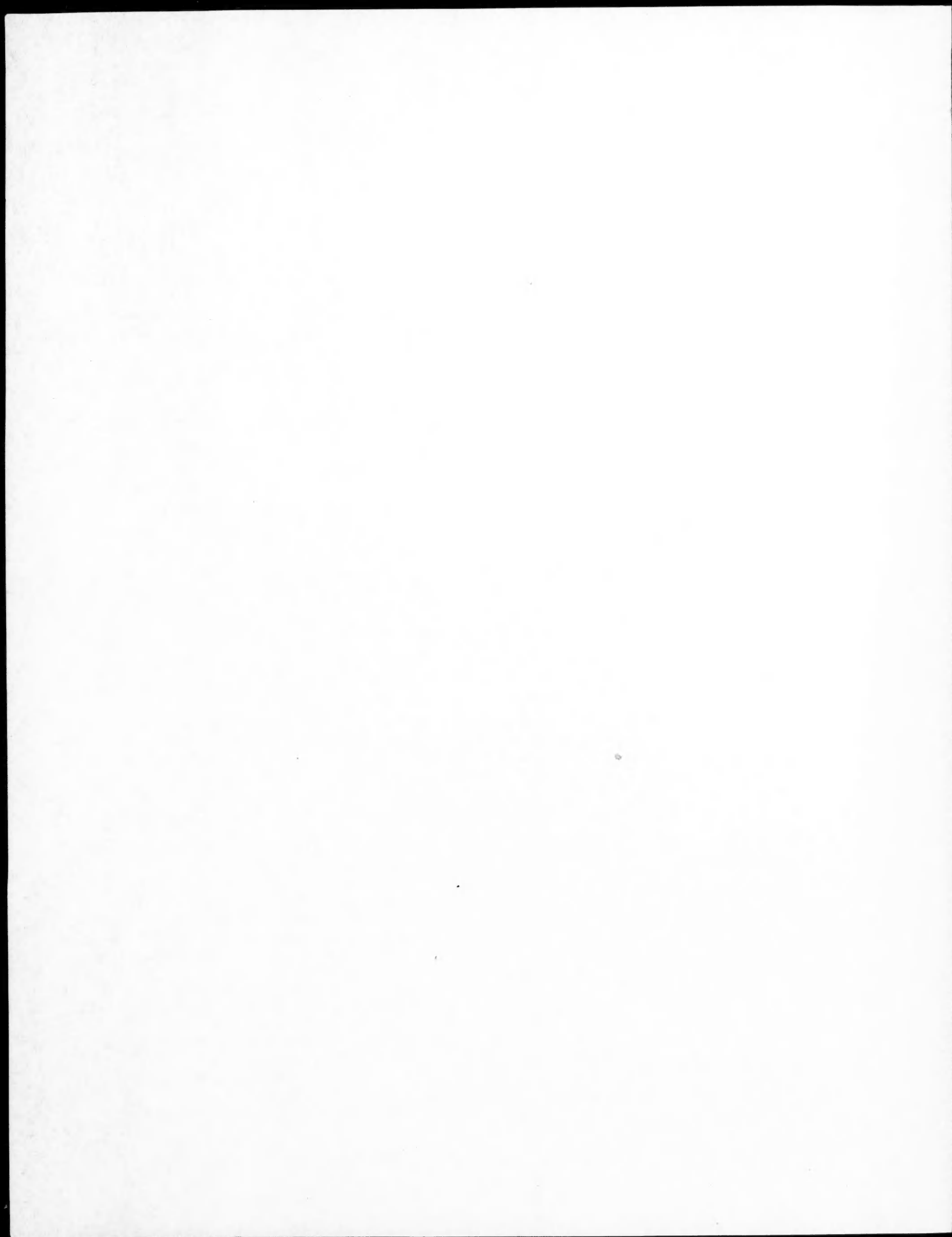
- a. The author submits a carefully typed ribbon copy of the manuscript ready for publication without corrections.
- b. He also submits an abstract of 600 words or less, accurately describing the contents of the manuscript, as a guide, but not as a substitute for the complete dissertation.
- c. Both the abstract and the manuscript must be approved by the candidate's committee and the Graduate Dean as ready for publication.
- d. The manuscript is microfilmed and the negative carefully inspected and put in the vault of University Microfilms for storage, where it is kept available for purposes of duplication upon request.
- e. The abstract is printed in DISSERTATION ABSTRACTS, which is distributed, both in this country and abroad, to a large number of subscribing libraries as well as to leading abstracting services.
- f. The charge for this service is \$20.00 irrespective of the size of the manuscript.
- g. Anyone, after consulting the abstract and concluding the complete manuscript would be of value, can obtain a microfilm copy from University Microfilms at 1 1/4 cents per page, or as a paper enlargement at 10 cents per page.

There are varying degrees of partial participation in this plan available at the option of the institution. Titles only will be listed in DISSERTATION ABSTRACTS for a charge of \$2.00 each. When a university wishes to prepare its own negatives according to certain specified standards, and have that negative stored at University Microfilms where it will be available for duplication, the charge is \$12.00, which includes publication and distribution of the abstract and storage of the negative. Conceivably certain institutions will wish not only to prepare their own negatives, but to service copies as well in either microfilm, microcard or microprint. In this instance the abstract will be printed in DISSERTATION ABSTRACTS, and any requests for copies will be forwarded to the servicing institution. Interested institutions should write University Microfilms for further details of this service.

This method separates the two necessary functions of publishing: notification, or the process of informing prospective users of the existence and contents of a manuscript and distribution, or the furnishing of a copy upon demand. Each of these functions pays its own way, since if no one wishes a copy, the investment is small. However, if there is a demand, copies can be produced at current book rates.

It is anticipated that by enlarging the scope of DISSERTATION ABSTRACTS this publication will become of increasing value to librarians and scholars as a research tool. If this ideal is to be realized, close cooperation between sponsoring institutions, doctoral candidates, and University Microfilms is of the utmost importance. Now that the service is available to all Graduate schools regardless of the way its candidates publish their dissertations, it is hoped that the goal of a complete bibliography of doctoral dissertations may be realized within the next few years. Institutions are urged to write for further details.

Beginning with Volume XIV, DISSERTATION ABSTRACTS will be published monthly.



CONTENTS

Page

AGRICULTURE

ANIMAL CULTURE

Genetic and Environmental Factors Affecting the Red Danish Cattle in Michigan -- Lester Joseph Cranek, Sr.	429
The Comparative Value of Selecting Swine Before and After Progeny Testing -- Stanley Lawrence Curtis	429
Purified Diet and Unidentified Growth Factor Studies in the Nutrition of the Chick -- Eldon Glen Hill	430
A Study of Corrections for Factors Influencing Feed Requirements of Swine in the Minnesota Swine Breeding Project -- Frederick Karl Kristjansson	431
The Estimates of Repeatability and Heritability of Milk, Total Butterfat and Percentage of Butterfat and Their Inter-Relationships in Indian Dairy Cattle -- Sahaja Nand Singh	431

FORESTRY AND WILDLIFE

The Correlation of Bark Beetles and Wood Borers to Slash Disposal in Michigan -- Walter Frederick Morofsky	432
---	-----

PLANT CULTURE

Seedstalk Development of Lettuce as Affected by Growth Regulators, Vernaliza- tion, Temperature and Photoperiod -- William T. Andrew	432
Inheritance of and Interrelationships of Tryptophan, Niacin, Protein, and Kernel Weight in Corn -- Chun-yen Kuo	433
Factors Affecting Development of Stalk Rot of Corn Caused by <i>Diplodia Zeae</i> and <i>Gibberella Zeae</i> -- Merle Edward Michaelson	434
The Entry of Nutrients Through the Bark and Leaves of Deciduous Fruit Trees as Indicated by Radioactive Isotopes -- Robert Lewis Ticknor	434

ANATOMY

Age Changes in the Cerebral Cortex -- Harold Brody	435
The Fifth Nerve of the Shrew -- John Baskerville Hyde	435

ANTHROPOLOGY

Cultural Change in a Costa Rican Village -- Manual Alers-Montalvo	436
---	-----

BACTERIOLOGY

New Procedures for Differentiating Specific from Non-Specific Agglutination in Brucellosis Serum and Milk Tests -- Aryadasa Amarasinghe	437
In Vitro Phagocytosis of Influenza Virus -- Arthur Victor Boand, Jr.	437
Effect of Culture Media on the Resistance and Growth of <i>Micrococcus</i> <i>Pyogenes</i> Var. <i>Aureus</i> -- Anita Harriet Leavitt	438
The Role of Biotin in Carbohydrate Metabolism -- Albert Groombridge Moat	438
The Effect of Pneumonia, Produced by <i>D. Pneumoniae</i> , Type I, on the Ascorbic Acid of Tissues of the Guinea Pig -- Prahlad Chattopadhyaya Rajam	439

BACTERIOLOGY -- cont'd.	Page
An Attempt to Cultivate the SA Virus (Schultz) in Tissue Cultures -- Dighton Francis Rowan.	440
An Attempt to Cultivate the SA Virus (Schultz) in Developing Eggs -- Lea Isabel Sekely	440
Physico-Chemical Characteristics of Electrophoretically Purified Influenza Virus -- Donald Zane Silver.	441
A Study of Marine Myxobacteria -- Theodore Jack Starr.	441
Tricarboxylic Acid Cycle in <i>Alcaligenes Faecalis</i> -- Joseph Peter Uscavage	442
A Study of Induced Variation in <i>Salmonella</i> and the Possibility of Associated Physiological Changes -- John David White.	443

BIOLOGY — GENETICS

A Genetical Study of Human Breast Cancer -- Victor Elving Anderson.	444
A Possible Relationship Between the Action of Digitalis on Oxygen Consumption and Acetyl Choline Turnover -- Clara Elizabeth Dunn.	444
Incidence of Breast Cancer in the Daughters of Patients Who Had Breast Cancer a Generation Ago -- Harold Orbeck Goodman	445
An Inheritance Study of Corn Maturity -- Champ McMillian Jones.	445

BOTANY

Effects of Boron on Pectins and Other Constituents in Sunflower -- Paul Richard Ashworth.	446
On the Morphology, Anatomy, and Phylogeny of the Psilotaceae -- David William Bierhorst	447
The Additive and Antagonistic Effects of Various Growth Regulators on the Straight Growth of <i>Avena</i> Coleoptiles -- Arthur George Carroll	447
The Flora of Southwestern Iowa -- Marcus Joseph Fay	448
Ammonium and Nitrate Nitrogen in Nutrition of Tomato Plants on Pumice and Gravel Substrates -- John Hacskaylo.	449
Studies on Some Light Activated Processes in <i>Rhodospirillum Rubrum</i> -- James Alexander Johnston.	449
A Study of Carbonic Anhydrase in Plants -- Eugene Hans Lucas.	450
Physiology of <i>Endoconidiophora Fagacearum</i> , the Fungus Causing Oak Wilt, with Special Reference to Growth and Toxin Production in Synthetic Media -- Irene Ginsberg White	450

CHEMISTRY

CHEMISTRY, GENERAL

A Critical Study of the Chromatographic Separation of Calciferol from Ergosterol -- Jean Bullard Burnett	452
The Kinetics of the Gallium Chloride Catalyzed Addition of Hydrogen Chloride to Olefins -- Martha Ellen Havill	452
A Study of Some Complexes of the Group III and Group V Halides -- Robert Richard Holmes	452
A Study of the Reaction of Cellulose Nitrate with Various Reducing Agents -- Frank John Masuelli	453
Sulfonation of Ketones of Singular Structure -- Peter T. Mori	453

CONTENTS

vii

CHEMISTRY -- cont'd.	Page
Volumetric Behavior of the Methanol-n-Butane System -- Leonard Beck Petty.	454
Benzo-1, 4-Dithiadiene -- Thomas Michael Roder	454
I. The Chromatographic Separation and the Determination of Vitamin D ₂ in Corn Oil. II. The Chromatographic Separation and the Determination of Vitamins D in Various Oils Containing Vitamin A -- Tom Daniel Schlabach, Jr.	456
Studies in Vapor-Phase Esterification -- Michael Stusiak.	456
Studies in Molecular Structure: The Raman and Infrared Spectra of the Series (CH ₃) _x SnCl _(4-x) -- Curtis H. Ward	456
The Ultraviolet Irradiation of Calciferol in Various Solvents -- Robert Yates	457
CHEMISTRY, BIOLOGICAL	
Studies of the Physical Properties of Some Bulk Laxatives -- Jack Norman Bone	457
A Study of Invertase -- Joseph Anthony Cifonelli.	457
The Properties of Some Fungal Lipases and Their Role in Grain Deterioration -- Brinton Marlo Dirks	458
Diphosphopyridine Nucleotide Pyrophosphatase in Venom and Mammalian Tissues -- Dean Paul Epperson.	459
Studies on the Gums Derived from Barley Flour, Wheat Flour and Fresh and Stale Bread -- Kenneth Albert Gilles	459
Displacement Separation of Lipids -- James Guthrie Hamilton, Jr.	460
The Constitution of Starch -- John Kelvin Hamilton	461
The Chemistry and Analysis of Highly Unsaturated Fatty Acids -- Earl Gullette Hammond	461
Quantitative Histological Distribution of β -Glucuronidase in the Adrenal Gland in Various Physiological States -- Som Nath Nayyar	462
The Constitution of Iles Mannan: Part I: The Structure of Iles Mannan. Part II: The Colorimetric Determination of Sugars -- Paul Armand Rebers	463
The Mechanisms of Enzymic Reactions of Phosphate as Studied with Sodium Azide, 2, 4-Dinitrophenol and Compounds of Tervalent Phosphorus -- Hugh Elburn Robertson	463
CHEMISTRY, INORGANIC	
Metal Complexes with Optically Active Diamines -- Richard Charles Toole.	464
CHEMISTRY, ORGANIC	
The Synthesis of Mono and Dibenzofluorene Derivatives for Anti-Cancer Investigations -- Prince Gordon Harrill.	465
Part I: Reactions of Nitroolefins with Diazocompounds. Part II: Reactions of Benzo-1,4-Dithiadiene -- William Robert Hasek.	465
Cyclopropanes IX: A Review of the Work of Kohler and Williams: An Attempt to Prepare an Allenic Ketone -- Earl Douglas Holly	466
The Reaction of Metals with 1,4-Dihalides and Some Similar Compounds -- Thomas Herbert Liddicoet	468
The Preparation of Some Alkenylborines -- Theran Duane Parsons	469
Contributions to the Chemistry of Umbellulone -- James Carroll Selover	469
Syntheses and Reactions of Sulfonic Anhydrides -- Paul Herman Settlege	470
Studies in a Synthesis of Dehydroabiatic Acid -- Edward Lockwood Wheeler	471

CHEMISTRY -- cont'd.	Page
CHEMISTRY, PHARMACEUTICAL	
The Reformatsky Reaction in the Synthesis of Compounds Having Potential Amebacidal Activity -- Andrew Lasslo.	472
A Study of Factors Influencing the Release of Certain Anti-Infective Agents from Emulsion Type Dermatologic Vehicles -- Krishna Chandra Varma	472
CHEMISTRY, PHYSICAL	
On the Role of Lateral Interaction in Physical Adsorption -- William MacLeod Champion	473
An X-Ray Spectrometer Study of Elemadienolic Acid -- Richard Milton Curtis	473
The Kinetics of the Sulfite-Thiosulfate Exchange Reaction -- Mother Charlotte Anne Dames	474
Solid State Reactions: Investigation of Color and Compound Formation in the Systems $ZrO_2-SiO_2-V_2O_5$ and $Cr_2O_3-Al_2O_3-ZnO$; Diffusion of Chromium Oxide Through Alumina -- Charles Holmes Herty III	475
The Crystal and Molecular Structure of B_5H_{11} -- Louis Richard Lavine	475
Chromatographic Behavior, Solubilities, and Partition Ratios of Ergosterol and Calciferol in Solvent Mixtures -- Frederick J. Miller, Jr.	476
The Stability of Ion Exchange Resins to X-Rays -- Robert E. Wedemeyer.	476
Part I. The Reduction of Hexavalent Chromium at a Nickel Anode-Nickel Sulfate Solution Interface During Electrolysis. Part II. The Effects of Chromium in Nickel Sulfate Solutions on the Physical Properties of Electro- deposited Nickel -- John Kenneth Werner	477
An Investigation of the Cerous-Sulfate Complex Ions by the Spectrophotometric Method -- Raymond George Wymer	478
ECONOMICS	
ECONOMICS, GENERAL	
Management Training Films: Their Design, Production, and Application -- Claude Swanson George, Jr., and Robert James Parden.	478
An Economic Analysis of the Impact of the Price Support Program Upon the Development of the Potato Industry in the United States -- Roger Winks Gray	479
Management Problems of Indiana Hatcheries -- Ronald L. Stucky	479
ECONOMICS, COMMERCE - BUSINESS	
Labor Union Attitudes and Policies Relating to Production Standards and Wage Incentives Based on Time Studies -- Clifford Mason Baumbach	480
Effects of Decentralized Management in Selected Industries -- Daryl Gordon Mitton	481
EDUCATION	
EDUCATION, GENERAL	
A Study of the Vocational Rehabilitation Problems of Tuberculous Patients Referred for Counseling to Educational and Vocational Counselors of the Anti-Tuberculosis League of King County Between October 21, 1946, and September 1, 1950 -- Alma Viola Armstrong	482
The Construction and Analysis of a Guide for Evaluating Elementary School Buildings and Sites in Citizen School Surveys -- Gerald Walter Boicourt	483
The Relation of Reading Ability to College Mortality of Certain Entering Freshmen at the University of Washington in the Year 1950-1951 -- Lelwyn Clyde Breen	483

CONTENTS

ix

EDUCATION -- cont'd.	Page
A Review of the Influences Bearing on the Development of Programs in Industrial Education -- Walter Ernest Ditzler	484
Community Relationships of Business Teachers in the High Schools of Illinois (Excluding Chicago) -- James Francis Giffin	485
A Historical and Structural Survey of Audio-Visual Techniques in Education, 1900-1950 -- Maurice T. Iverson	485
A Study of the Relationship of Selected Socio-Economic Factors to Outcomes of the Program of General Education at Michigan State College -- Carroll Milton Pike, Jr.	486
A Study of the Organization and Administration of the Teacher Placement Services in Ten Selected Universities -- Harold Eugene Sponberg	487
EDUCATION, ADMINISTRATION	
School Health Records in Health Counseling of Children and Parents -- Charlotte Luise Ehling	487
A Program for the Improvement of Elementary Education in Iran -- Abbas Ekrami.	488
A Study of School Board Elections in Santa Clara County -- William Ellis Gould	489
A Study of Elementary School Organization -- Richard Gordon Hansen	489
Learning Outcomes of Sixth Grade Pupils Under Alternate Grade Organization Patterns -- Charles Thomas Hosley	490
The Administration of Public School Insurance Affairs -- John Russell Kent	491
Factors Affecting the Academic Success of Foreign Students in American Universities -- Forrest G. Moore	492
Report Card Practices as Viewed by High School Pupils and Teachers -- Quirino Louis Paolazzi	493
An Evaluation of the Duties and Responsibilities of a Small District Superintendent of Schools in a Selected Midwest Area -- George Spencer Pritchard	494
Follow-Up Data and Curriculum Reorganization in a Union High School District -- Edward Thomas Walsh	495
EDUCATION, HISTORY	
An Historical Analysis of the Development of the Use of Collateral Reading from 1900 to 1950 -- Edward James Kelly	496
EDUCATION, PHYSICAL	
The Relationship of Depth Perception to Goal Shooting in Basketball -- Joseph Fletcher Dickson	497
EDUCATION, PSYCHOLOGY	
Leadership Behavior in College Social Groups -- Carroll Vernon Galbreath.	497
A Normative Study of the Revised Strong Vocational Interest Blank for Men -- Theda Hagenah	498
The Relationship Between Reading Ability and the Use of Communication Media by Adolescents -- Roberta Anna Evalin Johnson	499
A Follow-Up Study of College Trained Versus Non-College Trained High School Graduates of High Ability -- Edward Orley Swanson.	499
The Function of the MMPI in Determining Fitness for Student Teaching at the Nursery School, Kindergarten, and Primary School Level -- Earl Theodore Zwetschke	500
EDUCATION, TEACHER TRAINING	
The Imperatives of the Community School Concept for Student Teaching Programs -- Leon Morris McClure.	501

EDUCATION -- cont'd.	Page
EDUCATION, THEORY AND PRACTICE	
The Effect of the Systematic Analysis of Errors on Achievement in the Study of Fractions at the Sixth Grade Level -- Orville Bendolph Aftreth.	501
The Role of the Laboratory and Demonstration in College Physical Science in Achieving the Objectives of General Education -- Louis William Balczak.	502
Critical Factors Involved in the Evaluation and Use of Occupational Information in Agriculture in the North-Central Region -- Tollie Raymond Buie.	503
The Use of Analysis of Variance in Estimating the Components of Variation in an Experimental Study of Learning: Textbook-Centered Versus Laboratory-Centered Approach in the Teaching of Introductory High School Chemistry -- William Harrison Lucow	504
The Relationship of Reading Ability to the Newspaper Reading Done by Adolescents -- Helen Lucille Wardeberg.	505
ENGINEERING	
ENGINEERING, GENERAL	
A Study of Electromagnetic Flowmeter Design and Operation -- James Hayden Fisher	506
ENGINEERING, AERONAUTICAL	
Analysis of Landing Gear Impact Including the Effects of Wheel Spinup -- Charles William Coale	506
On the Aerodynamics of Wings at Transonic Speeds -- John Robert Spreiter	507
ENGINEERING, AGRICULTURAL	
Electric and Inertial Forces in Pesticide Application -- Henry Dittimus Bowen	507
ENGINEERING, CHEMICAL	
Gasification of Washington Coal -- Louis Martin Dvoracek.	508
A Study of Heat Transfer to Liquid-Solid Suspensions in Turbulent Flow in Pipes -- Aven Patterson Miller, Jr.	508
The Efficiency of a Droplet Reflux Rectification Column -- Sanford Milton Roberts	509
ENGINEERING, ELECTRICAL	
Resonance Phenomena in Time-Varying Circuits -- Mariano Companero Herrero	510
ENGINEERING, MECHANICAL	
Temperature Gradients in the Boundary Layer with Heat Transfer -- Louis Edward Bothell	510
A Theoretical and Experimental Investigation of Factors Influencing Instrument Gear Accuracy -- La Verne Frank Knappe	511
Irreversible Thermodynamics of Vapor Transmission Through Porous Media -- Raghunath Ganpatrao Mokadam	511
ENGINEERING MECHANICS	
Large Deflections of Circular Plates -- Roy Francis Hooley	512
Elasto-Plastic Bending of Beams on Elastic Foundations -- Paul Seide	513
Displacement and Stress Discontinuities in Rings, Cylinders, and Cones -- James Cammack Wilhoit, Jr.	513
ENGINEERING, MINING	
Dry Control of Dust Formed During Percussion Drilling -- Howard Levi Hartman	514

CONTENTS

xi

Page

GEOGRAPHY

- Glacial Deposits of the Yorkville, Illinois, Quadrangle -- Robert Dean Rudd. 515

GEOLOGY

- The Petrology and Structure of the Palau Volcanic Islands -- Gilbert Corwin. 516
 Geochemical Study of Chert and Related Deposits -- John Alfred Maxwell. 516

HEALTH SCIENCES

HEALTH SCIENCES, SURGERY

- Pathology and Pathogenesis of Regional Enteritis -- Ward N. Van Patter. 517

HISTORY

HISTORY, MODERN

- Human Nature in Politics: A Study of Walter Lippmann -- Earl Samuel Beard. 518
 Nazi War Aims: The Plans for the Thousand Year Reich -- John Robert Bengtson. 518
 Li Hung-Chang and the Huai-Chün -- Stanley Spector. 519
 American Attitudes Toward Machine Technology, 1893-1933 -- Lowell Tozer. 520

LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, GENERAL

- Class and Status in the American Novel, 1789-1850 -- Arnold Gerhard Nelson. 521
 The Moral Conservatism of Edith Wharton -- Mary Lund Rice. 521
 The Comic Element in Beaumarchais' Le Barbier de Seville and Le Mariage de Figaro -- Frank Boardman Wood. 522

LANGUAGE AND LITERATURE, MODERN

- Hugo von Hofmannsthal and Pedro Calderón de la Barca: A Comparative Study
 -- Vernon Lockwood Anderson. 523
 W. B. Yeats and T. S. Eliot: Poetic Drama and Modern Poetry -- Herbert Blau. 523
 The Doctrine of Repentance as a Formal Principle in Some Elizabethan
 Plays -- Dolores Gallagher Cunningham. 524
 James Joyce's Revisions of Finnegans Wake: A Study of the Published Versions
 -- Fred Hall Higginson. 525
 A Study of the Relationship of Thematic and Stylistic Variation in Jeremy
 Taylor's Prose -- James Roy King. 525
 Shakespeare and the Christian View of Man -- Reverend Joseph George Milunas, S.J. 526
 Asa Greene, New England Publisher, New York Editor and Humorist, 1789-
 1838 -- Arthur Lachlan Reed. 527
 The Function of Evil in Schiller's Dramas -- Eric Rosenbaum. 527
 An Edition of the Complete Poetical Works of Edward Taylor -- Donald Elwin Stanford. 528
 Marcel Proust: Aspects of Anglo-American Criticism -- Gérard Raymond Tougas. 529
 William Marion Reedy: A Critical Biography -- Fred Wilhelm Wolf. 529

LANGUAGE AND LITERATURE -- cont'd.	Page
LANGUAGE AND LITERATURE, LINGUISTICS	
The Phonological Theory of the School of Prague: An Exposition and Revision -- Herbert Merzbach.	530
MATHEMATICS	
Certain Probability Limit Theorems and Transformations of Stochastic Processes -- Robert Ernest Fagen	531
Group Extensions by Left Loops -- James Harold McKay.	532
On the Vibrations of Triangular Membranes -- Grove Crawford Nooney	532
On a Special System of Orthogonal Polynomials -- Albert B. J. Novikoff.	533
An Application of the Schiffer Variation to the Free Boundary Problems of Hydrodynamics -- Edward Blake McLeod, Jr.	533
PHARMACOLOGY	
Renal Hemodynamics as Influenced by Histamine -- William Peter Blackmore	534
The Roles of Titanium Dioxide, Bentonite and Sodium Carboxymethylcellulose in the Radiography of the Gastrointestinal Tract -- Charles Boyd Granberg	535
The Linguomandibular Reflex, a Neurophysiological and Neuropharmacological Study -- Ellen Eva King	536
A Pharmacognostical Investigation of <i>Chenopodium Botrys</i> L. and Related Species -- Robert Meyer Leonard	536
Influence of Alcohol on the Distribution of Barbiturates in Mammalian Tissue -- Komol Pengsritong	537
The Effects of Hypoxia and Certain Drugs Upon the Experimental Production of Bacterial Endocarditis in Rats -- Franklin Ernest Roth.	537
PHYSICS	
PHYSICS, GENERAL	
The Hall Effect in Ferromagnetics -- Frank Joachim Blatt	538
Propagation of a Sound Pulse in a Medium with a Complex Elastic Modulus -- Salah Izzat Tahsin	539
PHYSICS, NUCLEAR	
Nucleon Isobars in Intermediate Coupling -- Francis Harvey Harlow, Jr.	539
The Second-Forbidden Beta-Spectra of Co^{60} and Sc^{46} -- Glenn Leroy Keister	539
High Energy Phenomena in Nuclear Emulsions -- John Earl Naugle.	540
Elastic Scattering of Alpha Particles by Heavy Nuclei -- Harvey Edward Wegner.	540
PHYSIOLOGY	
The Effects of Stress, Corticotropin, Cortisone and Desoxycorticosterone on the Quantitative Histological Distribution of Ascorbic Acid in the Adrenal Gland of the Rat and the Monkey -- Robert Carlton Bahn.	541
Studies on the Electroarchitectonics of the Cerebral Cortex -- Nathaniel Avrom Buchwald	541
Hepatic Catalase in Relation to Transplantable Tumors in Rats -- Lester Edward Grubgeld.	542

CONTENTS

xiii

PHYSIOLOGY -- cont'd.	Page
The Contractile Activity of the Pregnant Human Uterus Prior to Labor: A Study with the Reynolds Tokodynamometer -- Irwin Herbert Kaiser	543
Pathophysiology of Trypsin, Trypsinogen, and Trypsin Inhibitor -- Martin Howard Kalser	543
Studies on the Absorption of Water from the Intestine -- Jui Shuan Lee	544
Some Studies on the Effects of Hypoxia Upon the Respiration and Circulation of Non Narcotized Dogs -- Gabriel Georges Nahas	544
Some Effects of Specific Dietary Alterations Upon the Life Span and the Causes of Death in C ₃ H Male Mice -- Y. Chiung Puh-Lee.	545
The Pituitary-Adrenal Factor in Sodium Homeostasis -- Daniel Harold Simmons.	545
Temperature, Ion, and Substrate Effects on the Rat Ventricle Strip -- Gerald Bonar Sutherland	546
Brain Stem Control of Micturition and Respiration -- Pei Chin Tang	546
The Central Arterial Pressure Pulse Contour as an Index to Left Ventricular Stroke Volume in Man -- Homer Richards Warner	547

POLITICAL SCIENCE

POLITICAL SCIENCE, GENERAL

Four American Columnists: A Study in the Partisan Anatomy of David Lawrence, Walter Lippmann, Drew Pearson, George Sokolsky -- Morton John Cronin	548
The Idea of Justice in Sociological Jurisprudence -- Eugene Victor Walter	548

PSYCHOLOGY

PSYCHOLOGY, GENERAL

The Emotional Reaction on Admission to a Tuberculosis Hospital -- David G. Berger.	550
Serial Rote Learning as a Function of Anxiety -- Ralph A. Enrick.	550
A Job Analysis by the Method of Critical Incidents of Psychiatric Aides in Mental Hospitals -- James Noble Farr	551
Forced-Choice Vs. L-I-D Response Items in Vocational Interest Measurement -- Dallis Kay Perry	552
A Comparison of Rating, Test, and Sociometric Methods of Personality Measurement -- David Lawson Russell	552
Relationships of Personality Factors and Religious Background Among College Students -- Hirsch Lazaar Silverman	553
Behavioral Correlates of Authoritarian Personality -- William DeWitt Wells	554

PSYCHOLOGY, CLINICAL

Prediction of Maladaptive Responses Under Conditions of Habit-Interference from Rorschach Color Responses -- Robert Willard Harrington	555
--	-----

PSYCHOLOGY, EXPERIMENTAL

Vasomotor Conditioning in Human Subjects -- Charles Wilson Harwood	555
The Generation of the Fractionated Goal Response by Differential Effector Activity at the Goal Box -- Marvin James Herbert	556
The Effect of Secondary Reinforcement on the Learning of a Multiple-Unit Maze -- Vonne Frank Porter	557
A Theory of Discrimination -- Frank Restle	558

PSYCHOLOGY -- cont'd.	Page
Electrocortical Activity and Induced Behavior Disorders -- David Rosenberg	558
A Study of Figural Equivalence in the Pigeon -- Arnold Lester Towe	559

RELIGION

The Syntax of the Greek Article: Its Importance for Critical Pauline Problems -- Robert Walter Funk	559
--	-----

SOCIAL PSYCHOLOGY

Adolescent Role Relationships in the Dynamics of Prejudice -- Dean George Epley	560
The Effectiveness of Social Group Work in the Development of Qualitative Participation -- Helen Northen	561
The Consistency of Social Conformity Behavior -- Roderick Francis O'Connor	561
Certain Determinants and Correlates of Authoritarianism -- Sidney Siegel	562
Factors Associated with the Compatibility of Roommates: A Test of the Birds- of-a-Feather Hypothesis -- Robert Gordon Zumwinkle	563

SOCIOLOGY

SOCIOLOGY, GENERAL

A Comparative Study of Non-Truant and Truant Children -- Joseph Andriola	564
Urbanism and Dependency: A Test of a Certain Value Theory in Rural Sociology -- Harry Vincent Kincaid	564
Intermarriage Between Divergent Ethnic Groups as an Index of Assimilation -- Michael Edward Kolivosky	565
A Comparative Analysis of the Decision-Making Process in Community Organization Toward Major Health Goals -- Paul Ausborn Miller	566

SOCIOLOGY, FAMILY

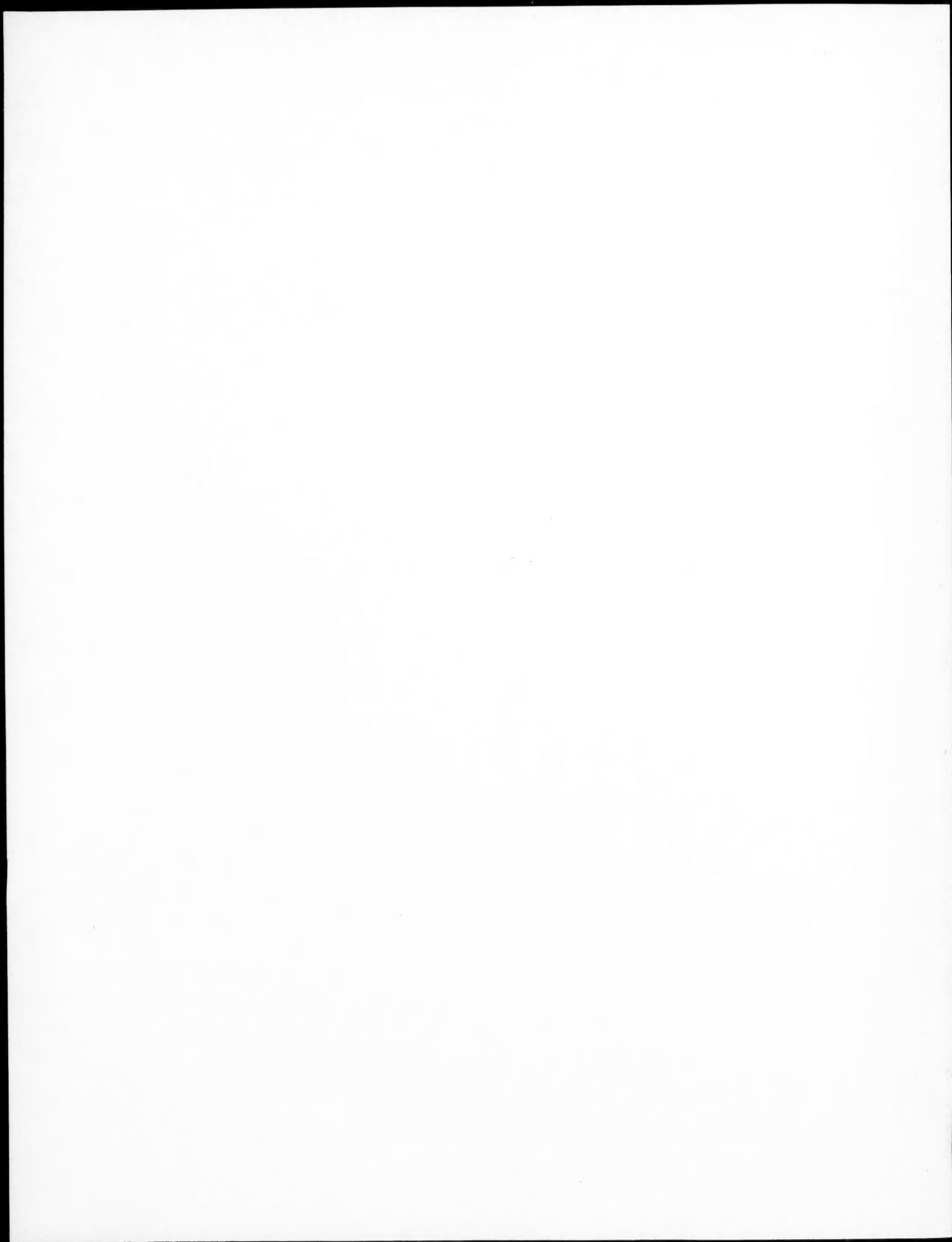
A Study of the Applicability of Selected Marital Success Criteria in Certain Population Groups -- Arthur LaVerne Johnson	567
---	-----

SPEECH — THEATER

An Analysis of Value Judgments in Selected Secondary School Plays -- Arthur Harold Ballet	567
The Ordinal Position Effect in Radio Audience Research -- Samuel Leo Becker	568
A Critical Analysis and Comparison of Selected 1932 Presidential Campaign Speeches of Herbert Clark Hoover and Franklin Delano Roosevelt -- Nicholas McKinney Cripe	569
The Representation of the West in American Drama from 1849 to 1917 -- Stuart Wallace Hyde	570
The Characterization of the Male Protagonist in Serious American Drama from 1867 to 1920 -- Willard Welsh, Jr.	570

ZOOLOGY

The Whitefish, <u>Coregonus Clupeaformis</u> (Mitchill), of Northern Lake Michigan, with Special Reference to Age, Growth, and Certain Morphometric Characters -- Prentice Alvin Caraway. .	571
Analysis of Hypertrophy and Atrophy of Denervated Skeletal Muscle -- Doris Mae Stewart	572
Embryology of the Mouthparts of Anoplura -- Joseph Hardie Young	572



AGRICULTURE

AGRICULTURE, ANIMAL CULTURE

GENETIC AND ENVIRONMENTAL FACTORS AFFECTING THE RED DANISH CATTLE IN MICHIGAN

(Publication No. 7477)

Lester Joseph Cranek, Sr., Ph.D.
Michigan State College, 1952

Analyses were made of all normal lactation records in the American Red Danish cattle population in Michigan prior to August, 1951, to determine the effect on production characteristics of Red Danish sires when mated to cows of the various dairy breeds in a grading-up program. The progeny of forty-one herd sires were represented within the sire progeny groups there were available 693 dams daughter comparisons. All lactation records of 270 days' duration or more were standardized to 305 day, 2X, mature equivalent basis by means of D.H.I.A. factors.

A significant increase in milk and butterfat production of the Red Danish cross progeny over the foundation breeds was found. The mean milk and butterfat production for the foundation breeds and their graded-up progeny was 8,536 and 9,116 pounds of milk, and 354 and 372 pounds of butterfat, respectively. There was no evidence of heterosis among the various breeds and crossbred animals. This increase was not attributed to an upward time trend in production. Estimates of repeatability of production records for the foundation breeds on an all herds and an intraherd basis were 0.54 and 0.36 milk production, and 0.66 and 0.37 for butterfat production, respectively. Those found for the Red Danish progeny on an all herds and an intraherd basis were 0.52 and 0.26 for milk production, and 0.67 and 0.28 for butterfat production, respectively.

The effect of mild inbreeding was analyzed by the intrasire regression of production on inbreeding. A nonsignificant decline of 23 pounds of milk and 0.3 pound of butterfat per 1-percent increase in inbreeding was observed. The analysis showed that some sires withstand inbreeding, whereas others did not. The gets of inbred sires were no more uniform milk and butterfat production than those of noninbred sires.

Two lethal defects, paralyzed hindquarters and mummification (a type of ankylosis), were found to be transmitted by the Red Danish sires. The observed frequency, of 2.2 and 1.4 percent for the paralyzed and mummified conditions, respectively, fitted the Mendelian inheritance ratio as simple recessive autosomal characters. The frequency of the heterozygous carriers in the population for the paralyzed and mummified conditions appears to be 25 and 11 percent, respectively. There appeared to be an increase of calf mortality and female sterility with each successive cross of Red Danish sires.

The performance of herds sires as indicated by progeny and dam-daughter comparisons is presented for thirty-one sires having at least five dam-daughter pairs. Twenty-four sires increased production. When divided into sire family groups, it was found all families were alike in transmitting ability, as calculated by the "Equal-Parent Index," which these data fitted.

The influence of three nonhereditary factors, time trend and yearly environmental changes, month of calving, and length of calving interval on milk and butterfat production. Of the total observed variance for milk production, 2 and 3 percent was attributed to the month of calving and the length of calving interval, respectively, while 2.4, 3.2, and 6.7 percent of the total observed variance for butterfat production was attributed to the month of calving, length of calving interval, and year-to-year changes, respectively.

Microfilm copy of complete manuscript of 336 pages, \$4.20. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-605.

THE COMPARATIVE VALUE OF SELECTING SWINE BEFORE AND AFTER PROGENY TESTING

(Publication No. 7279)

Stanley Lawrence Curtis, Ph.D.
University of Minnesota, 1953

The records of performance of eight inbred lines of Poland China swine consisting of 1,281 litters have been analyzed to determine whether a breeding herd of gilts or a mixed age group of breeding females would give greater genetic gain. All eight lines were developed and maintained at the Minnesota Agricultural Experiment Station in cooperation with the United States Department of Agriculture Regional Swine Breeding Laboratory.

Selection was made on five economic characters, (1) number of live pigs farrowed, (2) number of pigs weaned, (3) conformation score, (4) economy of gain and (5) growth rate. Selection differentials were determined on the actual herd composed of gilts and reselected sows, as well as on a gilt herd composed of gilts actually selected plus a sufficient number of gilts selected theoretically to complete a gilt herd of equal proportion to the mixed age herd. These two herds were then compared to determine from which breeding age structure the greatest genetic gain would be obtained.

The result of the analysis demonstrated in most of the lines that the increased length of generation interval offset the increased accuracy of selection in reselected females. A comparison of expected

genetic gain due to selection in number of pigs farrowed, weaned, conformation score and growth rate (daily gain) between the theoretical gilt herds and the actual herds of each line showed that more genetic gain would have been obtained in the theoretical gilt herd. Comparison for growth rate (154 day weight) and economy of gain between the same herds of each line indicated that the expected genetic gains were greater in the actual herd. It would appear that gilt herds perform better in those traits where their own actual performance record is used than in those traits where the performance record of the dam has been substituted.

The results of this analysis further indicated that gilt herds from lines with the greatest genetic width possible from crossing of lines within the breed has generally performed better than lines of narrower genetic base. Furthermore, the use of a flexible mating system appears to have been beneficial in producing high performing lines while maintaining inbreeding at a moderate increase.

The combination of crossing lines, the use of a flexible mating system and rigid selection for economic characters as practiced in this study indicates that gilt herds could be established which would perform equal to and possibly better than herds of mixed ages.

From this analysis it appears that swine breeding herds can be successfully selected for economic characters before progeny test performance records are available.

Microfilm copy of complete manuscript of 177 pages, \$2.21. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-606.

PURIFIED DIET AND UNIDENTIFIED GROWTH FACTOR STUDIES IN THE NUTRITION OF THE CHICK

(Publication No. 6384)

Eldon Glen Hill, Ph.D.
University of Minnesota, 1953

Experiments were conducted with normal, undepleted chicks fed purified basal diets of both an all-vegetable protein type and an all-animal protein type. These purified diets were improved and developed to the point that they would support chick growth during the first four weeks equal to practical chick rations containing animal constituents not including fish or liver products.

The addition of 7.5% soybean oil meal or 10% wheat bran to the casein-gelatin type diets resulted in a growth response of variable magnitude when chicks were fed diets adequate in all known nutrients. The evidence presented showed the need of the chick for an unknown nutrient present in these supplements for more rapid growth. No specific deficiency symptoms other than the lack of maximum growth were noted in the absence of the nutrient supplied by soybean oil meal. The data suggested that New Hampshire

chicks had a higher requirement than the White Leghorn chicks for the unknown nutrient, probably because of their inherently faster growth rate.

The alpha protein (all-vegetable protein) diets were improved by the addition of thiamine and DL-methionine in excess of NRC requirements to the point where further supplementation with 10% soybean oil meal failed to show a consistent growth response. This suggested that the alpha protein (isolated from soybean oil meal) was in itself a carrier of the unidentified nutrient, in view of the fact that the need of the chick for the nutrient present in soybean oil meal was demonstrated with the casein-gelatin diets.

Sources of the nutrient were shown to be soybean oil meal (7.5% or more), 10% wheat bran, fishmeal (7.5% or more) and 5% torula yeast in the presence of 5% cellulose. The torula yeast was not active in the absence of cellulose.

The unknown nutrient was shown not to be identical with the whey factor, reported by Hill (1948) to be in dried whey.

The data did not give conclusive evidence as to the identity of the soybean oil meal nutrient with the fish factor, but suggest that the fish meal contain a factor showing a similar effect.

The evidence showed variable growth promoting properties of both orotic acid and L-lyxoflavin when added to the diets in combination with certain other supplements, notably soybean oil meal, dried whey product, and dried yeast. The growth promoting action of orotic acid in combination with these products showed that orotic acid was neither the same as the whey factor nor the unknown nutrient in soybean oil meal.

In view of the insolubility of petroleum ether of the unknown nutrient in soybean oil meal, it probably is not the same as vitamin B₁₃. This is further substantiated by the fact that a vitamin B₁₃ concentrate was found active for chicks fed a corn-soybean oil meal diet (Austin and Boruff, 1949).

The evidence presented showed no consistent growth promoting activity for dehydrated alfalfa meal, xanthine, dried brewers' yeast, dried whey, torula yeast, cellulose, orotic acid or L-lyxoflavin when added individually to the purified diets.

The heavy mortality observed in chicks fed both types of diets was shown to be primarily a vitamin E deficiency, although the probability of a secondary thiamine deficiency was possible, as shown by increased growth observed in chicks fed the alpha protein diets supplemented with higher levels of thiamine. The vitamin E content of the diet was found to be maintained at an adequate level by the following modifications and treatment of the diets: the use of 4% corn oil in place of soybean oil as a fat constituent and carrier of the fat-soluble vitamins, the use of 1 mg. % alpha tocopherol acetate in the diet in place of alpha tocopherol, the use of a ferrous iron salt in the mineral supplement in place of a ferric iron salt and refrigeration of the mixed ration at -4° C. for storage conditions.

Microfilm copy of complete manuscript of 140 pages, \$1.75. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-607.

**A STUDY OF CORRECTIONS FOR FACTORS
INFLUENCING FEED REQUIREMENTS OF
SWINE IN THE MINNESOTA SWINE
BREEDING PROJECT**

(Publication No. 7242)

Frederick Karl Kristjansson, Ph.D.
University of Minnesota, 1953

Data gathered by the Minnesota Agricultural Experiment Station from 1943 to 1948 were analyzed to determine the relationships which exist between 56 day weight (W_1), 140 day weight (W_2), 154 day weight (W_3), feed consumption from 56 to 140 days of age (F_1) and feed consumption from 56 to 154 days of age (F_2). Two hundred and sixty test groups including seven different lines at five experimental sub-stations were included in the analysis. The covariance analysis was performed on a "within station" basis.

Simple correlations calculated from the 56-140 day data were as follows: $r_{W_1 W_2} = .63$, $r_{F_1 W_1} = .43$, $r_{F_1 W_2} = .71$. None of the regressions concerned deviated significantly from linearity. The partial and multiple correlations calculated were as follows: $r_{W_1 F_1 \cdot W_2} = -.03$ (not significant), $r_{W_2 F_1 \cdot W_1} = .63$, $r_{W_1 W_2 \cdot F_1} = .51$, $r_{W_2 (F_1 W_1)} = .80$. It is concluded that the relatively high simple correlation between 56 day weight and feed consumption from 56 to 140 days is due primarily to the high correlation between 56 day weight and 154 day weight and the fact that 154 day weight is highly correlated with feed consumption up to 154 days of age. About half the variance in feed consumption from 56 to 154 days of age is accounted for by differences in 154 day weight. The "within station" regression of 56-154 day feed consumption on 154 day weight was 2.22 and the individual station regressions did not deviate significantly from one another.

The simple, partial, and multiple correlations between 56 day weight, 154 day weight, and feed consumption from 56-154 days of age were as follows: $r_{W_1 W_3} = .59$, $r_{F_2 W_1} = .43$, $r_{W_1 F_2 \cdot W_3} = -.03$ (not significant), $r_{W_3 F_2 \cdot W_1} = .68$, $r_{W_1 W_3 \cdot F_2} = .45$, $r_{W_3 (F_2 W_1)} = .81$. The simple regressions did not deviate significantly from linearity. The simple "within station" regression of 56-154 day feed consumption on 154 day weight was 2.53, or, stated differently, each pound increase in 154 day weight was accompanied by an increase of 2.53 pounds in total feed consumption from 56 to 154 days of age. Again, about half of the variance in 56-154 day feed consumption could be accounted for by differences in 154 day weight.

It is suggested that corrected feed requirements "Fre" per 100 pounds gain be calculated using the following formulae. For 56-140 day data,

$$Fre = \frac{F_1 + 329.0 - 2.22 W_2}{W_2 - W_1} \times 100$$

For 56-154 day data

$$Fre = \frac{F_2 + 441.5 - 2.52 W_3}{W_3 - W_1} \times 100$$

These corrections are applicable only to the populations studied.

Microfilm copy of complete manuscript of 40 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-608.

**THE ESTIMATES OF REPEATABILITY AND
HERITABILITY OF MILK, TOTAL BUTTERFAT
AND PERCENTAGE OF BUTTERFAT AND
THEIR INTER-RELATIONSHIPS IN INDIAN
DAIRY CATTLE**

(Publication No. 7265)

Sahaja Nand Singh, Ph.D.
University of Minnesota, 1953

The data for this study included the Sahiwal, Tharparkar and Hariana breeds of cows belonging to various Government Dairy Farms in India. The records were compiled and published by the Indian Council of Agricultural Research in a series of miscellaneous bulletins numbered 18, 36 and 52 entitled "Milk Records of Cattle in Approved Dairy Farms in India." All the available normal records up to eight lactations of each cow were included for statistical analysis.

All lactation records used for this study were standardized to a twice a-day milking, 80 days service period, mature equivalent basis. The factor 0.833 commonly used by the U.S. Bureau of Dairy Industry was used to reduce 3X milked record to twice milking basis. But the factors used for the standardization for other major non-hereditary sources of variation were derived from the Indian records for each breed separately. The average gestation period of Indian cattle is 285 days. Consequently a S. P. of 80 days has been selected as the standard, because with this S. P. and a normal gestation period of 285 days the cow will calve at yearly intervals. Conversion factors with respect to service period were derived separately for first calvers and older cows. Finally conversion factors for mature equivalent were derived in terms of age in lactations rather than chronological age. The peak lactations based on the analysis of present data were fourth for Sahiwal and Tharparkar and fifth for the Hariana breeds of cows.

The estimates of how nearly a cow tends to repeat her performance record after record (repeatability) were 0.33 for milk production, 0.55 for butterfat production and 0.47 for butterfat percentage for Sahiwal breed. These estimates were 0.45, 0.47 and 0.54, respectively, for Tharparkar and 0.34, 0.56, and 0.57, respectively for Hariana breed of cows.

Heritability estimates were derived from lifetime averages by use of intraclass correlation between

production of paternal half sisters. Heritability estimates derived were 0.24 for milk production, 0.40 for butterfat production and 0.37 for butterfat percentage for Sahiwal breed. These estimates were 0.32, 0.28 and 0.44, respectively, for Tharparkar breed of cows. The heritability estimate was 0.28 for milk production in Hariana cows. The data of Hariana breed was not adequate for estimating heritability of other characteristics.

The phenotypic correlation between lifetime average milk and butterfat yield was found to be 0.91; between milk yield and butterfat percent, -0.17; and between butterfat yield and butter percent, 0.44 for Sahiwal breed. The corresponding correlations were 0.81, -0.056 and 0.20 for Tharparkar breed and 0.82, -0.13 and 0.52 for Hariana breed of cows.

The genetic correlations were estimated only for the first two breeds by the ratios of genetic covariance to the geometric mean of genetic variance estimates. The estimated genetic correlations were 0.80 between milk and butterfat yield, -0.10 between milk yield and butterfat percent and 0.46 between butterfat yield and butterfat percent for Sahiwal breed of cows. The corresponding genetic correlations were 0.72, -0.02 and 0.23 for Tharparkar breed of cows.

Microfilm copy of complete manuscript of 108 pages, \$1.35. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-609.

AGRICULTURE, FORESTRY AND WILDLIFE

THE CORRELATION OF BARK BEETLES AND WOOD BORERS TO SLASH DISPOSAL IN MICHIGAN

(Publication No. 7472)

Walter Frederick Morofsky, Ph.D.
Michigan State College, 1952

Studies on the correlation of bark beetles and wood borers to slash disposal in Michigan were of primary importance in this study. Caged material and field collections in red pine (*P. resinosa*) and jack pine (*P. banksiana*) plantations showed two species of the Family Cerambycidae (wood borers) and seven species of bark beetles belonging to the Family Scolytidae.

All of these insects are of economic importance in slash disposal methods, since some species build up in the slash to epidemic proportions to attack living trees, whereas others aid in slash break-down.

Slash disposal methods at the Kellogg Forestry Tract and the Higgins Lake State Forest were studied, as both areas were infested with wood borers and bark beetles. Recommendations of slash disposal such as lopped and scattered, windrowing, piling, and lopped and left were common practices in these two

areas, and from observation, these types of disposal are conducive to insect infestations. These methods were checked as to insect populations under field conditions and were found to encourage enormous numbers of insects which sometimes built up to epidemic proportions. In addition, two of the more common methods of windrowing and piling of red and jack pine slash were studied in detail. Generally speaking, in these two methods, the "butt end" of the slash is exposed. It was found, however, that by reversing this procedure in these two methods of slash disposal — that is, putting the "butt ends" toward the center of the windrow or piles — the establishment of insect populations could be inhibited to such an extent that no significant infestations developed. It was noted, however, that the height of the windrowing and piling was also a limiting factor. Where slash exceeded 36 to 40 inches in height, populations also increased in the upper part of the slash.

Fall cutting, proper slash management, and silvicultural practices may aid in reducing insect populations.

Chemical controls, biological controls, virus controls, and predators all may or may not be present to aid in the controlling of forest insects in our plantations. The factors which are of major importance to the silviculturist and entomologist alike are those which may influence the increase or decrease in insect populations. In this study, slash disposal technique was shown to be the most important of these factors.

Microfilm copy of complete manuscript of 175 pages, \$2.19. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-610.

AGRICULTURE, PLANT CULTURE

SEEDSTALK DEVELOPMENT OF LETTUCE AS AFFECTED BY GROWTH REGULATORS, VERNALIZATION, TEMPERATURE AND PHOTOPERIOD

(Publication No. 7155)

William T. Andrew, Ph.D.
Michigan State College, 1953

A series of field and greenhouse experiments was conducted over a period of two years to determine the effects of vernalization, certain growth regulators, plant growing temperatures and photoperiod on the seedstalk development of a number of varieties of lettuce.

2,4-Dichlorophenoxyacetic acid (2,4-D) at concentrations of 1, 5, 10, 20, and 40 ppm applied singly and in repeated applications to lettuce plants at several stages of development resulted in a significant hastening of seedstalk development when applied to Great Lakes lettuce plants 94 days old, in a significant retardation when applied to Great Lakes and

Imperial 456 plants 65 days old and had no effect when applied to 65 day old plants of the Slobolt variety. The degree and nature of the response varied with the variety, the concentration of the solution, the time of application and the temperature at which the plants were grown. No significant differences were obtained by spraying with maleic hydrazide (50, 100, 500 ppm), *n p.* chlorophenylphthalamic acid (100, 500 ppm) or benzothiazol-2-oxyacetic acid (100, 500 ppm). Soaking seed in solutions of 2,4-D varying from 0.1 ppm to 10 ppm resulted in a decrease in the rate of and percentage germination as the concentration of the growth regulator was increased. Plants grown from seed soaked in 1 ppm 2,4-D before vernalization developed seedstalks more rapidly than plants from seed sown dry, but not as rapidly as plants soaked in water before vernalization. Soaking non-vernalized seed in 1 ppm 2,4-D or in water for 24 hours before seeding resulted in plants developing seedstalks more rapidly than control plants grown from seed sown dry in the customary manner.

Seed of Great Lakes, Imperial 456, Imperial 847, and Slobolt lettuce vernalized at a temperature of $40 \pm 2^\circ\text{F}$ for 16 days resulted in significantly earlier seedstalk development and flowering compared with control plants grown from seed handled without cold treatment. Plants grown from seed subjected to low temperatures and moist conditions without previous soaking in water produced seedstalks as early as plants from seed allowed to soak before low temperature treatment. Plants of head lettuce varieties (Great Lakes, Imperial 456 and Imperial 847) grown from vernalized seed developed almost entirely without the customary head formation. Cold treatment of seeds sown in flats of moist soil was as effective as the laboratory technique involving the use of petri dishes provided treatment was applied no later than seedling emergence. Vernalization in seed flats offers a seemingly practical solution to obtaining desired seed production from hard headed and long standing lettuce varieties.

A night temperature of 60°F was more effective than a night temperature of 50°F in increasing the rate of seedstalk development of plants subjected to vernalization or sprayed with 2,4-D. In the case of plants receiving vernalization plus a 2,4-D spray and those receiving neither spray nor cold treatment, the effect of the higher temperature was not so pronounced. Plants subjected to a photoperiod of 15 hours did not produce seedstalks earlier than those grown under a nine hour day unless the germinating seed had previously been vernalized. Although time of flowering was influenced by both temperature and photoperiod, neither factor appeared to be the limiting or controlling influence in determining vegetative or reproductive growth. The responses to variations in photoperiod indicate that classification of lettuce as a long day plant may not be justified.

Microfilm copy of complete manuscript of 84 pages, \$1.05. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-611.

INHERITANCE OF AND INTERRELATIONSHIPS OF TRYPTOPHAN, NIACIN, PROTEIN, AND KERNEL WEIGHT IN CORN

(Publication No. 7162)

Chun-Yen Kuo, Ph.D.
Michigan State College, 1953

The success of a breeding program to improve the quantity of the nutritive constituents of corn may be achieved with more information concerning the mode of inheritance and interrelationships of these constituents.

Sixty inbred lines and two crosses, W23 x R53 and W23 x Oh51A, were analyzed for tryptophan and niacin contents, using microbiological assay. Protein analyses were made for W23 x R53 and kernel weight was determined for both crosses. Interrelationships of these characters were investigated. The inheritance of these characters concerning dominance relationships, nature of gene action, gene numbers and heritability were studied.

Considerable differences in niacin and tryptophan contents were evident among the sixty inbred lines. The differences between high and low for niacin and tryptophan were 149.7% and 78%, respectively. Several inbreds were above average for both tryptophan and niacin and some lines were low in both.

In cross W23 x R53, significant positive correlations were found between protein and tryptophan and significant negative correlations between protein with niacin and tryptophan with niacin. This seemed to agree with tryptophan - niacin biosynthesis. Negative correlations between tryptophan and niacin were not significant in the cross W23 x Oh51A. In both crosses, there was a slight tendency for high tryptophan to be associated with large kernel weight and high niacin to be associated with small kernel weight. While a few of these correlations were significant, the relationships were small and of little value in a plant breeding selection program. Significant positive correlation for protein and kernel weight were found.

High niacin was dominant over low niacin in both crosses. Tryptophan and protein showed no phenotypic dominance. There was no dominance for kernel weight in the cross W23 x R53, while in W23 x Oh51A slight heterosis or complete dominance was indicated for large kernels.

It was not possible to determine whether the observed mean for these characters fitted either the arithmetic or geometric scheme of gene interaction since the values were similar.

Estimated gene numbers for tryptophan and niacin were low, indicating the relatively high possibility of selecting these characters in the segregating populations. Heritability of these characters differed in each cross. More encouragement for selection for tryptophan and niacin was present in W23 x Oh51A than W23 x R53.

There was considerable variability in the non-segregating populations, P_1 , P_2 , and F_1 for all the characters studied. Environmental factors might have caused part of this variation. Since these characters had no previous selection, it is possible that

there was some genetic variation among individuals within the parents used in these studies.

Niacin content was not affected by sweet corn pollen and slightly lower tryptophan content was found in the ears of plants outcrossed with sweet corn than in the selfed plants.

Microfilm copy of complete manuscript of 73 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-612.

FACTORS AFFECTING DEVELOPMENT OF STALK ROT OF CORN CAUSED BY DIPLODIA ZEAE AND GIBBERELLA ZEAE

(Publication No. 7286)

Merle Edward Michaelson, Ph.D.
University of Minnesota, 1953

Investigations made during 1950 through 1952 have shown that reduction in yield of corn due to stalk rot caused by *Diplodia zeae* and *Gibberella zeae* varies with the variety, pathogen, number of infections per stalk, and season. Reduction was greater in Minhybrid 504 than in Minhybrid 607 regardless of the pathogen; reductions caused by *D. zeae* were consistently greater than those caused by *G. zeae*. The average reduction in yield for both varieties and pathogens during 1950 was 13.2 per cent; during 1951, 7.4; and during 1952, 10.5 per cent. A single infection with a given pathogen caused approximately the same reduction in yield regardless of the position of the infection in the stalk. Infection involving more than one part of the stalk caused greater reduction in yield than from a single infection per stalk.

Two organisms may attack the same internode and grow harmoniously with each other. When different races of *D. zeae* and *G. zeae* were inoculated into corn at the same locus, no synergism nor antagonism was expressed; the amount of rot developing from this infection was approximately the same as when the more virulent pathogen of the combination was inoculated alone.

Certain environmental factors influence the development of stalk rot. Temperature had a pronounced effect on the development of this disease in controlled tests in the greenhouse and laboratory; rot developed more rapidly at 85° F. than at 65° - 75° F. The amount of rot was less in corn growing in soil flooded with water and in soil deficient in nitrogen than in the controls.

The susceptibility of the host varies with its stage of development. Weekly inoculations beginning when plants were about 8 inches high until the corn was in the hard dough stage indicated that corn is susceptible to stalk rot over a considerable period of time. The greatest amount of rot occurred from inoculations made about the time of pollination and for several weeks thereafter. The time of planting influences the amount of rot only in so far as it affects the development of the host.

The presence of certain diseases or factors that alter the nutrition of the host influences the severity of infection. There was a greater amount of rot in corn with a large smut gall near the top of the plant than in non-smutted plants when inoculated. In stalks which had been inoculated with *D. zeae* and *G. zeae* and later inoculated with the same organisms in different parts of the stalk, there was no effect of the early infection on the development of the rot from the second inoculation. When leaves of corn were removed or broken prior to inoculation, the plants were more susceptible than the controls. On the other hand, when ears were removed from the stalks, the plants were less susceptible than the controls.

The European corn borer has intensified the problems of stalk rot, but the present study indicated that the tunnels made by the corn borer as such do not make the plants more susceptible to stalk rot. However, stalk rot invariably follows damage by corn borers. Inoculations with *D. zeae* and *G. zeae* in plants with approximately 50 per cent of the roots cut to simulate damage by rootworms, showed no effect of the loss of roots on the development of subsequent stalk rot.

Information of this type is particularly important in the development of varieties of corn resistant to stalk rot. Parental and hybrid lines of corn should be tested for their resistance to a number of different pathogens under as many conditions as possible over a period of years in order to select lines which are truly resistant.

Microfilm copy of complete manuscript of 73 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-613.

THE ENTRY OF NUTRIENTS THROUGH THE BARK AND LEAVES OF DECIDUOUS FRUIT TREES AS INDICATED BY RADIOACTIVE ISOTOPES

(Publication No. 7169)

Robert Lewis Ticknor, Ph.D.
Michigan State College, 1953

Several factors which may influence the entry of mineral nutrients into the above-ground portions of fruit trees were studied by applying solutions containing radiocalcium, radiophosphorus, radiopotassium, and also some non-radioactive materials to the trees. These factors were: season of the year, length of absorption period, concentration of nutrients, differences between varieties, and affect of method of application.

Mineral nutrients were found to have entered through the bark of fruit trees following the application of mineral nutrients during the dormant season in limited quantity. Greater entry occurred following the application of the mineral nutrients to the bark after foliage growth had been produced in the spring. Entry of mineral nutrients applied to the

foliage occurred more readily while the new shoots were still expanding than after the shoots had matured.

Evidence was found that entry was still occurring 192 hours after application of radiophosphorus to bark of 3-year-old apple limbs. In the case of foliage application, entry was still occurring 24 hours after the application of radiophosphorus.

Solutions of 2, 4, 8, 16, and 32 percent concentration of calcium chloride, NuGreen, phosphoric acid, potassium nitrate, and a 20-20-20 fertilizer were sprayed on 1-year-old Montmorency sour cherry trees and 2-year-old McIntosh apple trees while the buds were dormant and while the buds were in the green tip stage. Very little injury was found when the trees were sprayed with any solution of 8 percent or less in concentration. Primarily, terminal buds were destroyed by calcium chloride and lateral buds by phosphoric acid when used at concentrations of 16 and 32 percent on either apple or cherry trees. The effects produced by 16- and 32-percent NuGreen and the 20-20-20 fertilizer which contained urea were different on apple and cherry trees. Many of the buds of the apple trees were killed when sprayed

while dormant with these materials but few were killed when sprayed while in the green tip stage. A marginal chlorosis or variegation of the cherry leaves was found following the use of either NuGreen or the 20-20-20 fertilizer at both growth stages. Potassium nitrate had no effect at any concentration or at either growth stage.

Variations in maturity appear to be the principle cause for the differences in the intake of radiophosphorus noted when the leaves of several varieties of apple and peach shoots were dipped into radiophosphorus solution at any calendar date.

Entry following the applications of the radiophosphorus solution to a mechanically injured area or following the use of a continuously moist source of the radiophosphorus solution (a saturated cotton gauze) was greater than when the solution was applied by brush to the intact bark.

Microfilm copy of complete manuscript of 131 pages, \$1.64. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-614.

ANATOMY

AGE CHANGES IN THE CEREBRAL CORTEX

(Publication No. 7218)

Harold Brody, Ph.D.
University of Minnesota, 1953

The structure of the cerebral cortex has been studied according to the method of Bok. Age changes in the cortex have been investigated as revealed by this method and by the use of the periodic acid-Schiff technique.

Sections of cortex were removed from a human series ranging from birth to ninety-five years. The counting of cortical cells and the rank correlation of these results indicate that the greatest decrease in cell number occurs in the superior temporal gyrus followed closely by the precentral gyrus. The area striata is next involved. The postcentral gyrus shows the least change in cell number. In the precentral gyrus, a differentiation of the cortical layers was observed from the superior to the inferior extent of the gyrus. The portion closest to the lateral fissure reveals a cortical stratification. The superior portion is not delineated in this way. Layers II and IV are observed in the postcentral gyrus of all ages and are best demonstrated in the superior and temporal gyri.

In all ages, the pyramidal layer of the area striata is divided into outer, inner and middle portions. The largest number of cells is contained in the middle portion. Whereas all the cortical layers show a decrease in cell number with age, the external and in-

ternal granular layers are particularly affected. The dominant cell type in these layers in the newborn is the granule cell. However, in the older age groups these layers contain more small pyramidal cells than granule cells.

The periodic acid-Schiff technique was used to stain the pigment in the cells of the cerebral cortex. Results indicate that the number of cells with pigment increases with age, more cells containing pigment in the older age group than in any other. A greater number of cells in the area striata are free of pigment than in the other areas examined.

Microfilm copy of complete manuscript of 155 pages, \$1.94. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-615.

THE FIFTH NERVE OF THE SHREW

(Publication No. 7235)

John Baskerville Hyde, Ph.D.
University of Minnesota, 1953

The trigeminal complex in the soricid insectivores *Blarina brevicauda* and *Sorex cinereus* is of spectacular proportions due to the marked reduction of most of the other cranial nerves and the specialized smallness of the soricid brain in general. This point has been brought out in drawings and photographs of the shrew brain which depict the predomi-

nant size of the peripheral portions of the trigeminus and the extensive central connections of that nerve.

More detailed examination of the central nuclei of the soricid trigeminus reveals histological divisions corresponding rather closely to those in man. At the same time, the disposition of the components of the mesencephalic nucleus of the trigeminus displays certain features characteristic of the monotreme and marsupial mammals, and even of the sub-mammalian

vertebrates. Thus, these tiny insectivores, belonging to the order from which evolved the primates, while possessing complexities of neuronal organization approaching those of man, also have features of structure that relate them to the ancient ancestors of the mammals.

Microfilm copy of complete manuscript of 117 pages, \$1.46. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-616.

ANTHROPOLOGY

CULTURAL CHANGE IN A COSTA RICAN VILLAGE

(Publication No. 7154)

Manuel Alers-Montalvo, Ph.D.
Michigan State College, 1953

This is a study in cultural change, based on ten months of intensive field work in Costa Rica. The author was motivated by a theoretical interest in the dynamics of cultural change. The study carries a personal hope that it may be of utility in orienting programs of cultural change in Latin America, and in other regions which are considered under-developed.

Since 1951 the Interamerican Institute of Agricultural Sciences, in Turrialba, Costa Rica, has undertaken a rural education program in selected villages of the area. Attention has been focused on the use of the local teacher as a change agent. The principal objective of the present study was to investigate the consequences of this program in a particular village. There was interest in finding out what had changed — as a result of the teacher or any other change agent — how it had changed and why it had changed.

The investigator lived continuously for five months in the village of San Juan Norte. San Juan Norte is a strongly religious village of small proprietors in which almost everyone is kin to everyone else, and where social class divisions are almost nonexistent. There are sixty families in the village, with a total population of 336.

A general schedule was administered to practically all the male heads of family. Information was requested on demography, selected practices in agriculture, health, nutrition, housing and clothing. Another general schedule was administered to practically all the housewives. This schedule was similar to the male's except that the section on agriculture was not stressed.

Analysis of the schedule for men permitted the selection of three practices in agriculture and health-nutrition for intensive study as to why they had been accepted or rejected. The practices chosen were: (a) the use of insecticide chlordane — universally adopted in the last two years; (b) the cultivation of home vegetable gardens — stressed by the change agents in the last two years, but virtually rejected; and (c) the cultivation of POJ sugar cane — universally adopted during the last ten years.

A set of similar hypotheses was postulated to account for the adoption or the rejection of each practice. Schedules on each of the three practices were administered to a small sample of village farmers. An analysis of all the data collected revealed that three variables had been crucial in determining the acceptance or rejection of a practice; (a) felt need, (b) degree of compatibility of the practice with the local culture and (c) the presence or absence of "objective proof" of the efficiency of the new item. For example, chlordane and POJ sugar cane were accepted because villagers felt a need for them, they "fitted" into the local culture and objective proof of their efficiency was furnished. Vegetable gardens, on the other hand, were not accepted because people felt no need for them, they did not fit into the local culture and no objective proof of the feasibility of regularly cultivating them was furnished.

Other variables such as "leadership," prestige and the image that villagers had of the change agent were not found to be as significant as the above-mentioned three.

Microfilm copy of complete manuscript of 250 pages, \$3.13. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-617.

BACTERIOLOGY

NEW PROCEDURES FOR DIFFERENTIATING SPECIFIC FROM NON-SPECIFIC AGGLUTINATION IN BRUCELLOSIS SERUM AND MILK TESTS

(Publication No. 7212)

Aryadasa Amarasinghe, Ph.D.
University of Minnesota, 1953

In searching for a practical field test to differentiate between specific and non-specific reactions to the agglutination test for brucellosis, it was found that a rough strain of *Brucella abortus* would in at least a high percentage of the cases absorb quite effectively the non-specific agglutinins without removing the specific agglutinins for *Brucella*. This property of a rough strain was used as the basis of developing several absorption tests which offer promising indications of serving as a practical differential field test.

Three drops of a 30 percent by volume suspension of a rough strain of *Brucella abortus* effectively absorbed the non-specific *Brucella* agglutinating substance or substances from 0.4 ml. of bovine serums showing suspect titers due to non-specific agglutinins. In a significant percentage of cases suspect titered serums showed a partial reduction in titers after the absorption indicating the presence of both non-specific and specific agglutinins. In these instances the chromatographic test also usually indicated the presence of both types of agglutinins.

In a comparative study on 519 bovine serums with low titers selected at random from the samples submitted for routine testing at the State Animal Diagnostic Laboratory, 100 indicated non-specific reactions by the absorption test and 84 by the filter paper chromatographic technique. These differences in results are believed to be due to the inherent differences in the two tests. The absorption test by comparison may be considered a quantitative test in that the titers of the serums are determined before and after absorption. The chromatographic test is a qualitative test as the degree of reaction is determined by the color intensity.

The differential absorption property of rough strains of *Brucella abortus* was also used to develop a differential plate or rapid test. The results of the comparative study on the 519 serums with suspect titers referred to above; the differential plate test indicated 97 non-specific reactions as compared to 100 and 84 for the absorption and filter paper tests respectively. This type of test is also worthy of extensive field tests to determine its reliability and efficacy.

A differential tube test was included in the comparative test on the group of 519 serums mentioned earlier. This test involves incubation of the tube test at 56° C. in a water bath for 18 hours, and the

titer obtained compared with the control test incubated in the usual manner at 37° C. Good agreement was obtained on the comparative tests on bovine serums with the results of the filter paper test namely 80 and 84 respectively. A problem encountered with a significant number of samples was the difficulty of reading the tests which received the 56° C. incubation.

The non-specific *Brucella* agglutinating material which cause positive reactions to the milk or cream ring test is not absorbed by cellulose or by rough strains of *Brucella* as is the case for bovine serums. This would suggest that milk and cream contains substances which interfere markedly with such absorptions. However, studies involving heat treatment suggest that heating milk and cream specimens in a water bath at 65° C. for two hours offers a possible method of differentially inactivating the non-specific agglutinins without significantly interfering with specific reactions to the ring test. The results of this study indicate that field trials should be made to determine the efficacy of such a differential test.

Microfilm copy of complete manuscript of 94 pages, \$1.18. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-618.

IN VITRO PHAGOCYTOSIS OF INFLUENZA VIRUS

(Publication No. 7080)

Arthur Victor Boand, Jr., Ph.D.
University of Illinois, Chicago Professional Colleges
1953

The importance of the cellular defense mechanism has long been recognized, but the function of these cells in diseases of viral etiology is little understood.

Lillie (6) reported the phagocytosis of psittacosis virus, and Smith (9), Fairbrother (4), Sabin (8), and others have reported the fixation of vaccinia virus by leucocytes. Other workers have also reported the phagocytosis of the viruses of Shope's fibroma (1), cattle plague (7), fowl plague (10), Rous sarcoma (2), and herpes simplex (5). Little knowledge of the actual relationship of the viruses to the phagocytes was obtained.

The purpose of this work was to attempt to demonstrate the in vitro phagocytosis of virus by direct methods. The fluorescent antibody method of Coons (3) and the cellular fractionation methods were employed.

Leucocytes were obtained from human heparinized blood, and after washing in physiological saline solution, virus was added and the suspension incubated at 37° C. for thirty minutes. Smears prepared from the leucocyte suspension were then stained with fluorescein-labeled immune serum and the

location of the virus detected by the deposited fluorescence. Uncombined fluorescent antibody was then removed by saline washing leaving only the specifically fixed antibody. Specificity of the method was demonstrated.

The influence of certain factors on the in vitro phagocytosis of influenza virus was studied. Viral phagocytosis was found to be greatly diminished by the presence of 1% ethanol and by incubation at 4° C. Mobility of the phagocyte was then essential for viral phagocytosis as it is for bacterial phagocytosis.

The necessity of viral adsorption prior to ingestion by the phagocyte was demonstrated by blocking viral adsorption by destruction of the cell receptor sites of the leucocytes. This was accomplished by the use of sodium periodate. The effect of normal and specific immune serum on viral phagocytosis was investigated on leucocytes from normal and immune animals. It was apparent that the presence of immune serum greatly stimulated phagocytosis, and similarly, leucocytes from immune animals showed greater phagocytic ability than did those from normal animals.

The intracellular location of the virus was demonstrated by fractionating leucocytes that had engulfed virus. Cells were ruptured and the various cellular components separated by differential centrifugation. The various components were identified and stained with the fluorescent antibody to determine the location of the virus. Virus was found to be associated with the cytoplasmic granules, to which it apparently was adsorbed; nuclear material was free of measurable virus.

Previous workers had shown that certain viruses were not inactivated by phagocytosis. Similar studies were carried out with influenza virus. Infectivity of the virus after phagocytosis was demonstrated by injecting leucocytes containing virus into embryonated hen eggs and measuring the development of hemagglutinins. Phagocytosis of this virus did not result in loss of infectivity for at least 24 hours in the absence of specific immune serum. Additional tests were run in the presence of immune serum, and the results indicated that the phagocytized virus was actually protected from destruction by immune serum by its intracellular localization in the phagocyte.

Influenza virus is apparently phagocytized in vitro much as are bacterial cells. Many of the factors related to bacterial phagocytosis are also related to viral phagocytosis. Certain differences are apparent also. Lymphocytes are involved in viral phagocytosis and are not so in bacterial phagocytosis. The immune mechanism is apparently of greater importance in viral phagocytosis than it is in phagocytosis in general. The exact role and significance of viral phagocytosis is not well understood.

Microfilm copy of complete manuscript of 79 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-619.

EFFECT OF CULTURE MEDIA ON THE RESISTANCE AND GROWTH OF MICROCOCCUS PYOGENES VAR. AUREUS

(Publication No. 7163)

Anita Harriet Leavitt, Ph.D.
Michigan State College, 1952

Micrococcus pyogenes var. *aureus* was grown in standard FDA broth, Difco Disinfectant Test (DT) medium and Trypticase Soy (TS) broth. FDA "phenol coefficient" tests and "semi-micro" tests were run using the organisms grown in the above-mentioned media. A phenolic, a chloro-phenol, a mercurial and a quaternary ammonium compound were selected as test compounds. DT medium, FDA broth and a specific neutralizing medium were used for subculturing when the tests were run.

Results indicated that the organisms grown in DT medium were more resistant to the four compounds tested than were the organisms that were grown in FDA broth or TS broth. A smoother culture was maintained in DT medium and TS broth than was in FDA broth, but variations in the resistance to phenol occurred with the organisms grown in each of the three media.

Results obtained with the "semi-micro" tests were not as consistent as those obtained by the "phenol coefficient" method.

Microfilm copy of complete manuscript of 83 pages, \$1.04. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-620.

THE ROLE OF BIOTIN IN CARBOHYDRATE METABOLISM

(Publication No. 7287)

Albert Groombridge Moat, Ph.D.
University of Minnesota, 1953

Investigations of the effect of biotin deficiency upon carbohydrate metabolism by washed cell suspensions of yeast showed that biotin was necessary for both the fermentation and oxidation of carbohydrates. In fermentation, the data obtained suggested that biotin functions as a cofactor in the system of reactions involved as well as aiding in the synthesis of one or more of the enzymes. In respiration, the evidence indicates that the role of biotin is primarily in the synthesis of enzymes required for rapid oxidation of glucose and other sugars. A comparison of the fermentation of glucose, sucrose and fructose by *Saccharomyces cerevisiae* strain 139 provides evidence that the hexokinase reaction may be the most plausible site of biotin action; however, because of certain theoretical considerations, the possibility of biotin functioning in other reactions in glycolysis is discussed.

The ability of aspartic acid to partially replace biotin in stimulating the rate of fermentation and oxidation of glucose by biotin-deficient cells of *S.*

cerevisiae 139 indicates that one of the most important sites of biotin action in controlling the carbohydrate metabolism of this organism is in the metabolism of this amino acid. The fact that biotin or biotin and aspartic acid in combination elicited a greater response than aspartic acid in the stimulation of glucose metabolism by yeast suggests that further roles for biotin in both fermentation and oxidation may exist. The possible sites of biotin function are discussed.

The more rapid rate of adaptation of biotin-deficient cell suspensions of *S. cerevisiae* 139 to sucrose fermentation in the presence of biotin indicates that this vitamin may be concerned in the synthesis of the adaptative enzymes necessary for fermentation of this sugar.

Methods of obtaining actively fermenting extracts of *S. cerevisiae* 139 after growth on a medium of known composition have been investigated. It has been found that cell-free extracts can be obtained if the growth medium is supplemented with casein hydrolysate.

Lactobacillus arabinosus strain 17-5 has been found to convert pyruvate quantitatively to carbon dioxide and acetylmethylcarbinol. The optimum pH for the activity of the enzyme system involved is between pH 3.0 and 4.0. It has been shown that the pH of the culture medium during growth of the organism must reach that required for optimum activity before maximum enzyme production occurs.

Vacuum-dried cells of *L. arabinosus* 17-5 retain their ability to convert pyruvate quantitatively to carbon dioxide and acetylmethylcarbinol. The ability of these dried cell preparations to decarboxylate α -acetolactic acid indicates that this compound is an intermediate in the formation of acetylmethylcarbinol by this organism.

Glucose, in catalytic amounts, has been shown to produce a marked stimulation of the rate of acetylmethylcarbinol formation by washed cell suspensions of *L. arabinosus*. Vacuum-dried cells were stimulated by glucose or adenosine triphosphate only when freshly prepared. Upon storage, glucose and adenosine triphosphate no longer stimulated the rate of pyruvate dissimilation of dried preparations. These findings suggest the possibility of a permeability barrier to pyruvate in intact cells of this organism which is destroyed after desiccation for long periods. Such dried cell preparations, however, retained their ability to metabolize pyruvate to carbon dioxide and acetylmethylcarbinol for long periods.

An investigation of the effect of biotin deficiency upon the formation of carbon dioxide and acetylmethylcarbinol from pyruvate and the decarboxylation of α -acetolactic acid to acetylmethylcarbinol by this organism suggest that biotin is not involved as a cofactor in this series of reactions.

Microfilm copy of complete manuscript of 113 pages, \$1.41. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-621.

THE EFFECT OF PNEUMONIA, PRODUCED BY D. PNEUMONIAE, TYPE I, ON THE ASCORBIC ACID OF TISSUES OF THE GUINEA PIG

(Publication No. 5717)

Prahlad Chattopadhyaya Rajam, Ph.D.
University of Michigan, 1953

In this study, the effect of pneumonia, produced by *D. pneumoniae*, Type I, on the ascorbic acid of guinea pig tissues is investigated.

Pneumococcus pneumonia is produced by intratracheal inoculation of between 4.0×10^7 and 1.0×10^8 organisms, suspended in hog gastric mucin, and the effect of the disease on the ascorbic acid of involved lung, and on that of liver, spleen, blood, and adrenal gland studied. The ascorbic acid of involved lung increases significantly 24 hours following inoculation, maximal increases occurring at 48 and 72 hours. The increased ascorbic acid is in the reduced form. No significant changes occur in the ascorbic acid of blood, spleen, or liver. Adrenal ascorbic acid decreases over the first 24 hours following inoculation. Part of this decrease is due to the trauma of the intratracheal inoculation procedure. Use of guinea pigs with low tissue ascorbic acid levels (but not scorbutic) results in increased ascorbic acid of involved lung, and no changes in that of liver and spleen. It appears that the increased ascorbic acid of lung is obtained at the expense of other tissues, but gradually, and in amounts not detectable by direct chemical analysis; and that depleted ascorbic acid of various tissues of infected animals (reported by others) cannot be explained on the basis of mobilization to a location where host-parasite reactions are proceeding at high intensity.

Intratracheal inoculation of about 10^8 pneumococci results in large numbers of organisms in liver and spleen; however, no change in ascorbic acid of these organs occurs. Therefore, changes (reported by others) in ascorbic acid of these tissues in systemic infections is probably not due to processes associated with heavily loaded phagocytic cells at these sites.

Pneumococcus pneumonia in the guinea pig results in significantly increased ascorbic acid levels in involved lung, beginning 24 hours after inoculation and becoming maximal at 48 hours and 72 hours. Microscopic pathological findings show that mononuclear cells appear in quantity and become the predominant cell type over this period. Inflammation of the lung produced by intratracheal administration of sterile 5 percent hog gastric mucin also results in increased ascorbic acid levels 48 and 72 hours after administration; these times also represent the appearance of mononuclear cells as the predominant cell type. Guinea pigs with extreme ascorbic acid deficiency (showing scorbutic symptoms) show no increase in lung ascorbic acid during pneumococcus pneumonia; further, the sequence of cell types is quite different from the above, since mononuclear cells do not predominate even 96 hours following inoculation. The clearance rate of pneumo-

cocci from the lung is depressed in these animals.

The significance of the increased lung ascorbic acid of guinea pigs suffering from pneumococcus pneumonia is not clear, although it appears to be associated with processes occurring during the phenomenon of the acute inflammatory response. If this is true, the findings may have some general significance in partially explaining the findings of others. However, direct extensions of the findings obtained with the particular host-parasite system here used to other host-parasite systems is probably not justified.

Microfilm copy of complete manuscript of 153 pages, \$1.91. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-622.

AN ATTEMPT TO CULTIVATE THE SA VIRUS (SCHULTZ) IN TISSUE CULTURES

(Publication No. 7505)

Dighton Francis Rowan, Ph.D.
Stanford University, 1954

The SA virus employed in this study was isolated by Dr. Edwin W. Schultz in 1951 in the course of studies on the "common cold" and though it is still in the process of being characterized, observations on it suggest that it is a previously unidentified neurotropic virus. Inoculated intracranially it is infectious for hamsters and young chicks but less infectious for mice. It has been carried through more than 25 serial brain to brain transfers in hamsters.

The present studies were carried out to determine the conditions under which this virus may be grown in tissue culture. Finely minced mouse embryo tissues and adult mouse testicular tissue were added to different kinds of fluid media, in accordance with the Maitland technic of suspended cell cultures, not only in an attempt to grow the virus in tissue cultures but to increase its infectivity for mice. In addition brain tissue or minced entire heads from hamster and chicken embryos were employed. The tissues were obtained from embryo mice 12 to 16 days old, embryo hamsters 9 to 12 days old, and embryonated chicken eggs 7 days old, respectively.

The fluid media included: Hank's balanced salt solution plus ox serum ultrafiltrate, Hank's balanced salt solution plus horse serum, and a modified Robbins' roller tube medium. Cultures were set up in 25 ml. Erlenmeyer flasks. To each flask 3 to 4 ml. of the fluid medium, minced tissue fragments in amounts equivalent to 5 per cent of the fluid volume of the culture, and a virus suspension in amounts equivalent to 10 per cent of the fluid volume were added. Ten per cent virus suspensions prepared from infected mouse brains served as the source of the virus in most of the experiments, while in certain experiments virus infected hamster brain or amniotic fluid from infected embryonated chicken eggs were employed. In all experimental work the pH of

the cultures was adjusted to 7.2 to 7.4 and the cultures were incubated at 37.5° C. In most experiments the cultures were incubated for 4 days, in others for 3 days, and in a few experiments for 5 days. At the end of each incubation period portions of the supernatant fluid from each culture were transferred to freshly prepared tissue cultures and in this way the initial material was carried through 3 to 5 serial passages in tissue cultures. At the end of certain passages, usually the 1st, 3rd, and 5th, portions of the supernatant fluids from the cultures were tested for the presence of the virus by intracranial inoculation of 0.03 ml. into each of 5 white mice and 0.05 ml. into each of 3 hamsters. The inoculated animals were kept under observation for periods of 3 to 4 weeks before the individual tests were considered closed and the final results recorded.

The results obtained suggest that no viral multiplication occurred in tissue cultures in which Hank's balanced salt solution plus ox serum ultrafiltrate was employed as the fluid medium. Minced mouse embryo brains or entire heads, or adult mouse testicular tissue, failed to support the growth of the virus when suspended in any of the three named fluid media. Cultures containing minced hamster embryo heads in a fluid medium consisting of Hank's balanced salt solution plus horse serum, or of Robbins' modified medium, did appear to support viral growth, as did cultures containing minced chick embryo heads in modified Robbins' roller tube medium.

In addition to tissue culture studies an attempt was made to adapt the SA virus to mice by brain to brain transfer. To date the virus has been carried through 13 consecutive brain to brain passages and is becoming more infectious for mice.

Microfilm copy of complete manuscript of 113 pages, \$1.41. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-623.

AN ATTEMPT TO CULTIVATE THE SA VIRUS (SCHULTZ) IN DEVELOPING EGGS

(Publication No. 7507)

Lea Isabel Sekely, Ph.D.
Stanford University, 1954

This dissertation deals with the cultivation in developing eggs of a seemingly new virus, the SA virus. This virus was originally isolated by Dr. E. W. Schultz in 1951 in connection with studies on the "common cold" at the National Institutes of Health, Bethesda, Maryland.

The study consisted of: (1) the preparation of hamster and chick brain virus suspensions suitable for inoculation into eggs; (2) preliminary adaptation of hamster passage virus to chicks by serial passage in chicks to improve the infectivity of the virus for chick embryo tissue; (3) the serial passage of the inoculated material by various routes in developing eggs of different ages, under different conditions of

temperature and incubation time; (4) testing of the infectivity of passage material in baby chicks and hamsters; and (5) the eventual determination by means of neutralization tests with specific antisera of whether the virus cultivated was actually the SA virus.

Of 5 different routes of inoculations employed in developing eggs, the intracranial, amniotic and allantoic proved successful as a means of propagating the virus. By the yolk sac route and the chorio-allantoic route only the first passages proved infectious for test animals. Infected amniotic and allantoic fluids were observed to agglutinate chick red cells, but only in low dilutions.

Microfilm copy of complete manuscript of 88 pages, \$1.10. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-624.

PHYSICO-CHEMICAL CHARACTERISTICS OF ELECTROPHORETICALLY PURIFIED INFLUENZA VIRUS

(Publication No. 7086)

Donald Zane Silver, Ph.D.
University of Illinois, Chicago Professional Colleges
1953

To date no method has been developed which will yield completely purified influenza virus. Techniques are available which result in the isolation of distinct virus particles. However, Knight reported that at least 20% of these particles, prepared by adsorption and elution from red blood cells followed by high speed centrifugation, was composed of host substances bound to the virus. Further purification of the influenza virus, thus is necessary in order to study the chemical and physical properties of the virus and to gain added insight into the nature of host-virus relationships. It appeared possible that electrophoresis in filter paper might provide a means of separating influenza virus from contaminating host material. The present study was undertaken to determine the size, sedimentation constant, chicken red blood cell agglutinating and specific activities of the influenza virus following exposure to electrophoresis in filter paper, and to determine from these data whether a more pure virus had been obtained.

Following two hours exposure to electrophoresis in filter paper the PRS influenza virus diminished in size from 97 mu to 64.5 mu, in sedimentation constant from 688 Svedbergs to 459 and increased in specific activity from 8,060 chicken red blood cell agglutinating units per mg of protein to 19,100. It appears that the procedure of electrophoresis in filter paper offers possibilities for the purification of viruses.

Microfilm copy of complete manuscript of 54 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-625

A STUDY OF MARINE MYXOBACTERIA

(Publication No. 7201)

Theodore Jack Starr, Ph.D.
University of Washington, 1953

The over-all objective of this investigation was to attain a general understanding of the marine members of the order *Myxobacteriales*. The approach to this problem necessitated the isolation and characterization of representative species.

Samples were collected from Port Orchard Bay and Port Madison Bay in Washington by a variety of oceanographic techniques. Other samples included aged sea water from the Beaufort Sea which is located north of Alaska. The samples of sea water, muds, sediments, cores, and plankton tows were plated on a variety of media designed for the purpose. In addition, enrichment media were inoculated prior to plating. A large number of samples and isolation media were used in order to obtain as wide a variety of representative myxobacteria as possible. Myxobacteria were isolated from the bay samples by direct plating; the aged Beaufort Sea samples required initial enrichment techniques prior to plating.

Myxobacteria were isolated from most of the samples. Eight types were selected for characterization of properties. They were representative of the myxobacteria observed during the course of this study. They were chosen on the basis of general properties which included: colonial characteristics and pigmentation, microscopic cellular differences, action on agar, and by the presence or absence of microcysts.

Characterization of the eight isolates was based on studies which included: cytological and morphological investigations, biochemical and physiological differentiation, nutritive requirements, and enzymatic activity.

Cytological and morphological investigations showed typical myxobacterial characteristics for all of the isolates. In general, they were slender, Gram-negative rods which possessed a considerable degree of flexibility and gliding motility. Colonial swarming was evident. Microcysts were present in some.

Biochemical and physiological differentiation was based on tests such as: presence or absence of catalase, cytochromes, and cytochrome oxidase; reduction of nitrates to nitrites; action on chitin, cellulose, starch, gelatin, agar, and eight sugars; tolerance to sodium chloride; and anaerobic growth. One species liquified agar, none used cellulose, and all were aerobic. The other characters differed with the species.

Minimal nutritive requirements of the isolates ranged from those species which could be grown on a mineral nitrogen base plus a carbohydrate to those species which in addition required amino acids and thiamin, and to those species which required chemically undefined growth factors.

Enzymatic studies on three of the isolates showed a typical glycolytic scheme. In addition an oxidative system was present. The oxidative scheme of one

isolate involved a triphosphopyridine nucleotide-specific glucose-6-phosphate dehydrogenase and a diphosphopyridine nucleotide-specific system which acted on 6-phosphogluconic acid. The end product of the latter reaction was not determined.

On the basis of these differential characters, five different species were recognized among the eight isolates investigated. Taxonomic positions for these species are recommended. The three marine members of the genus *Cytophaga* which had been described previously are considered also. Pending further investigation of fruiting body formation by freshly isolated strains, the eight myxobacteria studies can be classified in the following manner (Bergey's Manual of Determinative Bacteriology):

Family I. Cytophagaceae

Genus I. *Cytophaga*

Diagnosis: Flexible, sometimes pointed rods, showing creeping motility. No fruiting bodies or spores (microcysts) formed.

I. From soil.

II. From sea water.

A. Liquefies agar.

1. Starch utilized.

a. Cellulose utilized . . . 1. *Cytophaga kr-
zemieniewskae*

b. Cellulose not utilized. 2. Culture #PO4

2. Starch not utilized.

a. Nitrates reduced.

1) Gelatin liquefied. . . 3. *Cytophaga
diffluens*

b. Nitrates not reduced.

1) Gelatin not liquefied

4. *Cytophaga
sensitiva*

B. Agar not liquefied 5. Culture #PO1

Family V. Myxococcaceae

Genus IV. *Sporocytophaga*

Diagnosis: Microcysts formed loosely in masses of slime among the vegetative cells. Fruiting bodies absent.

I. Catalase negative. 1. Cultures #PO2
and #PO3

II. Catalase positive.

A. Nitrates reduced 2. Cultures #BS3
and #BS4

B. Nitrates not reduced 3. Cultures #BS1
and #BS2

Microfilm copy of complete manuscript of 163 pages, \$2.04. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-626.

TRICARBOXYLIC ACID CYCLE IN
ALCALIGENES FAECALIS

(Publication No. 7087)

Joseph Peter Uscavage, Ph.D.

University of Illinois, Chicago Professional Colleges
1953

The tricarboxylic acid cycle theory of the mechanism of pyruvate and acetate oxidation has been well substantiated by vast experimental work on animal tissues. Experimental evidence to support the presence of such a cycle in micro-organisms is both meager and contradictory.

However, whole resting cells of *Alcaligenes faecalis* grown on a glazed cellophane disk which covered an agar growth medium containing various members of the tricarboxylic acid cycle as a source of carbon, were found to have the ability to oxidize citrate, alpha keto-glutarate, fumarate, succinate, malate, oxalacetate, beta-hydroxybutyrate, acetoacetate, and acetate without a period of adaptation using the technique of simultaneous adaptation.

This technique presupposes that the cell wall of bacteria is permeable to all intermediates involved in a reaction chain. The principle is applied when it is feasible to formulate *a priori* the many metabolic pathways that might be followed in a specifically controlled respiratory process. In this manner one obtains possible intermediates for testing each formulation.

The enzymes involved in the substrate oxidation are of a constitutive nature, i.e., enzymes that are always present in the cell regardless of the substrate.

The enzymes were inactive to pyruvate oxidation and the activity to malate was decreased in comparison to the respiratory response of its homologous intermediates, succinic and fumaric acids.

The limiting factor in the case of malic acid was attributed to permeability difficulties of the cell wall. This anomaly was easily eliminated when a cell-free extract of *Alcaligenes faecalis* was prepared.

Interpreted in view of the simultaneous adaptation theory, the non-oxidation of pyruvate indicated that the formation of "active" acetate does not involve the participation of pyruvate as a condensation co-factor to form citrate and initiate the cycle. Permeability difficulties were ruled out when a cell-free preparation negated permeability as a factor.

Therefore, a different pathway into the cycle must exist and this pathway is supported by the finding of the oxidation of beta-hydroxybutyrate through acetoacetate and acetate initiating the tricarboxylic acid cycle in *Alcaligenes faecalis*.

Microfilm copy of complete manuscript of 80 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-627.

A STUDY OF INDUCED VARIATION IN
SALMONELLA AND THE POSSIBILITY OF
ASSOCIATED PHYSIOLOGICAL CHANGES

(Publication No. 7178)

John David White, Ph.D.
Vanderbilt University, 1953

Supervisor: Professor Ilda McVeigh

The objects of this investigation were: to induce variation in certain major somatic antigens of some strains of *Salmonella*; to produce phases of representative cultures of the monophasic types *S. paratyphi A*, *S. abortus equi*, *S. cholerae suis* var. *kunzendorf*, and *S. typhi* by use of different immune sera in order to gain information concerning the production of these phases, more specifically, the role of immune serum; and to determine what other physiological changes, if any, are associated with the antigenic changes.

Eight strains of *Salmonella* were subcultured for a number of times in a semisolid medium containing single factor O serum in an endeavor to produce variation. Similarly, attempts were made to produce variation in these eight strains and fourteen additional ones by use of unabsorbed O serum. Strains representative of groups A, B, and D of the Kauffmann-White schema were used. No loss of any major somatic antigen, no transformation or any alternation other than smooth to rough variation was observed in any of the strains examined.

An evaluation was made of the effect of different sera containing homologous agglutinins in inducing phase variation in the four monophasic types indicated above. Four d sera were used for *S. typhi*, five 1,5 sera for *S. cholerae suis* var. *kunzendorf*, four a sera in combination with z_{11} serum for *S. paratyphi A*, and four en. sera in combination with z_5 serum for *S. abortus equi*. Eight strains of each were used. A single colony of each strain was used to inoculate the tubes containing semisolid medium and serum. Thereafter, subcultures were made at intervals of 48 hours until a phase appeared. Experiments were terminated at the end of ten transfers in the event that no new phase appeared.

Only three of the four d sera employed were useful in obtaining the artificial phase from strains of *S. typhi*. The evidence indicated that the serum derived from *S. typhi* inhibited variation. Phase 1 of *S. cholerae suis* var. *kunzendorf* was obtained by the use of five different 1,5 sera; four being equally effective and one less effective. Absorption of the d and the 1,5 sera with the respective phase variants permitted isolation of phases after fewer subcultures than when the corresponding unabsorbed serum was used. Phase variation was obtained in *S. abortus*

equi and *S. paratyphi A* by the use of different sera but not as easily as in the first two species.

Several conclusions concerning induced phase variation may be drawn. Some monophasic types are less stable than others; therefore, phase variation can be induced in them much more readily than in the more stable forms. Differences also exist between strains of the same species. The major role of the serum appears to be one of selection; however, the evidence presented does not rule out the possibility that the serum is also responsible, in part or wholly, for the change in antigens of the parent strain whereby the new phase originates.

Various experiments were designed concerning the nature of the organic growth factor requirements of the strains of *S. typhi*, *S. cholerae suis* var. *kunzendorf* and of some of the phase variants derived from them to determine whether or not changes in nutrition could be correlated with antigenic changes. Eight other species of *Salmonella* were included among these in order to ascertain the nutritional requirements of this genus in general. The minimal medium for this purpose contained glucose, NH_4Cl , NH_4NO_3 , Na_2SO_4 , $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, CaCl_2 , K_2HPO_4 , KH_2PO_4 , and trace amounts of the following minerals: boron, copper, iron, manganese, molybdenum, and zinc.

Of the strains used in this investigation, the majority grow in a mineral salts medium containing glucose as a carbon source and either asparagine, arginine, or glutamic acid as the sole source of organic nitrogen. Glutamic acid is more readily available as a source of nitrogen for strains of *S. cholerae suis* var. *kunzendorf* than either arginine or asparagine.

All but four of the strains of *S. typhi* failed to grow in the mineral salts medium containing glucose and a mixture of amino acids but lacking tryptophane. Two failed to grow in the absence of isoleucine and one in the absence of serine. Histidine, hydroxyproline, isoleucine, serine, and threonine appeared to have a stimulatory effect on the growth of some of the strains of *S. typhi*. Cystine affected the growth of all strains in this manner. *S. blegdam* failed to grow when tyrosine was omitted from an otherwise complete medium. *S. rostock* required niacin for growth.

With few exceptions, the nutritional requirements and the biochemical reactions of the derived phase cultures agreed with those of the corresponding parent strains. No change in either nutritional requirements or biochemical reactions was found to be associated consistently with change in phase.

Microfilm copy of complete manuscript of 96 pages, \$1.20. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-628.

BIOLOGY - GENETICS

BIOLOGY, GENETICS

A GENETICAL STUDY OF HUMAN BREAST CANCER

(Publication No. 7213)

Victor Elving Anderson, Ph.D.
University of Minnesota, 1953

Information was obtained about the families of 539 women treated for breast cancer at the Tumor Clinic of the University of Minnesota Hospitals. A medical history questionnaire was sent to all living parents, sibs, and children (over 30 years of age). An attempt was made to obtain a death record for all dead parents, sibs, and children, and to verify all reported cancers and tumors.

The biases introduced by the selection of the *propositae* were explored, especially concerning the age at first diagnosis. The group of *propositae* included more young women and more rural women than would be expected for all women with breast cancer in Minnesota. However, these differences should not invalidate a genetic analysis.

Data on the fertility of the *propositae* indicated that the breast cancer rate may increase with increasing numbers of children when only women in the reproductive ages are studied, but show a decrease when all ages are included. Further study is needed.

The control group was composed of the parents and sibs of the husbands of *propositae*. It is believed that this control group is more adequate than the ones used in previously reported studies of breast cancer.

The effects of incomplete information were discussed. There is apparently no valid way to estimate the changes which would result from more complete information.

Expected numbers of persons with cancer were calculated by two different methods. Method A used proportional mortality rates and was limited to the analysis of dead relatives. Method B used cancer incidence rates. The results of two previous studies were presented in a comparable manner.

The observed number with breast cancer among sisters of the *propositae* was almost twice the number expected by comparison with the sisters of the husbands (a significant difference). Further information is needed for the interpretation of the breast cancer rate among mothers. There was no evidence for an excess of cancers other than breast among parents or sibs.

In summary, it is the present author's opinion that a familial excess of breast cancer has been established beyond reasonable doubt. However, the data presented do not permit a conclusion as to whether or not genetic factors are primarily responsible for this excess. Also, no method is known which could be used to determine what type of in-

heritance might be involved. These considerations illustrate the difficulties met in trying to interpret the genetic background of a common disease which is apparently strongly influenced by non-genetic factors.

Microfilm copy of complete manuscript of 199 pages, \$2.49. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-629.

A POSSIBLE RELATIONSHIP BETWEEN THE ACTION OF DIGITALIS ON OXYGEN CONSUMPTION AND ACETYL CHOLINE TURNOVER

(Publication No. 7170)

Clara Elizabeth Dunn, Ph.D.
Vanderbilt University, 1953

Supervisors: Dr. R. J. Neff and
Dr. Margaret E. Greig

One aspect of digitalis action concerns its influence on oxygen consumption both in vivo and in vitro. The effect of digitalis is characterized by a stimulation of respiration followed by an inhibition (a biphasic response). One theory is that the cardiac glycosides by acting at the surface of the cardiac cell cause a change in the permeability of the cell which may be responsible for the action of the drug on respiration. Evidence in support of this theory is that the effect of the glycoside is dependent upon intact cell structure (*i.e.*, glycosides do not affect the respiration of homogenates or isolated mitochondria, that digitalis profoundly affects the penetration of potassium into and out of the cardiac cell, and that upon injection of radioactive glycosides into the circulation, 60-80% of the glycoside is found bound to the insoluble residue of the cell. In view of the fact that an alteration of the internal potassium content of the cardiac cell affects respiration, it would appear that the glycosides act on the cell membrane, altering the permeability of the cardiac cell to potassium and this, in turn, affects cellular respiration.

Evidence from this laboratory has shown that the metabolism of acetyl choline is an important controlling factor in the transfer of ions into and out of cells. Furthermore, it is known that the digitalis glycosides affect the action of acetyl choline. Therefore, if the turnover of acetyl choline alters the internal ionic content of the cardiac cells, and alteration of the internal potassium content affects respiration, then the cardiac glycosides may exert their effect on respiration through alteration of the cellular turnover of acetyl choline. The purpose of this investigation is to determine whether or not the action of the cardiac glycosides is related to the cellular turnover of acetyl choline.

Addition of lanatoside C ($5 \times 10^{-6}M$) to actively respiring ventricle slices produces a biphasic respiratory response of cardiac tissue accompanied by

a loss of potassium from the cells and a stimulation of acetyl choline hydrolysis. By modifying the rate of potassium loss from the cell, it is possible to modify the biphasic action of the glycoside on respiration, and to alter the effect of the drug on cholinesterase activity (i.e., decreasing the rate of loss of potassium from the cell prevents the effect of the glycoside on respiration and acetyl choline hydrolysis).

From these observations, it appears that the cardiac glycoside produces its effect by altering the rate of turnover of acetyl choline, which, in turn, alters the permeability of the cardiac cell to potassium, which, in some yet undetermined fashion, alters cellular respiration.

Microfilm copy of complete manuscript of 74 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-630.

INCIDENCE OF BREAST CANCER IN THE DAUGHTERS OF PATIENTS WHO HAD BREAST CANCER A GENERATION AGO

(Publication No. 7227)

Harold Orbeck Goodman, Ph.D.
University of Minnesota, 1953

This study presents an analysis of the frequencies of cancer in the sisters, daughters, and sons of 77 *propositae* selected from the records of the University Hospitals and the Pathology Department of the University of Minnesota. The *propositae* were women who had breast cancer between the years 1910 and 1925. The analyses included only those relatives for whom medical history questionnaires, death records, or other reliable data concerning the presence or absence of neoplasms were available.

Of 73 sisters, 8 were found to have or have had breast cancer, and 10 were found to have had cancers of other sites. The minimum risk a sister has of developing breast cancer is, from these data, 11 per cent. Comparing these observed cancers with the number expected according to New York morbidity rates showed that there was a significant excess of breast cancer, but no increased number of cancers of other sites. These results closely parallel those of Penrose (1948) and Anderson (unpublished data).

Among 151 daughters, 8 have already developed breast cancer, and 7, cancers of other sites. Comparing those with the expected numbers using Iowa morbidity data, the daughters have a significant excess of breast cancer, but like the sisters, no demonstrable excess of cancer of other sites. The daughters appear to have about three times as great a likelihood of developing breast cancer as a woman in the general population. A control group of females, 100 wives of the *propositae's* sons, had the same number of breast cancers as were predicted by the Iowa statistics, and only a slight deficiency of cancers of all sites, findings which suggest the suitability of the Iowa rates for calculating expectancies.

The sons of the *propositae* showed no excess of cancer, their number being slightly smaller than the expected number.

No conclusions are possible with regard to the mode of inheritance involved. All recent studies are in essential agreement on the excess of breast cancer which appears in the sisters of patients with breast cancer. Jacobsen, alone, finds excesses of cancers of all sites in the mothers, sisters, fathers, and brothers of his *propositae*. It is possible that the excesses he found resulted from his method of calculating the expected numbers of cancers.

Microfilm copy of complete manuscript of 48 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-631.

AN INHERITANCE STUDY OF CORN MATURITY

(Publication No. 7469)

Champ McMillian Jones, Ph.D.
Michigan State College, 1952

The inheritance of maturity and ear weight were investigated with six different crosses of early x late inbred lines of corn. Dominance relationships, gene numbers, nature of gene action, and heritability were studied. Silking date, moisture content of ears harvested at a uniform period from time of planting, and ear moisture content fifty days after silking, were used as measures of maturity. Data on ear weight were obtained at two harvest periods.

In each cross, either complete phenotypic dominance or slight heterosis for earliness was indicated in all maturity studies. Some degree of heterosis for earliness was probably involved in each cross; however, the major portion of the observed earliness appeared to be due to dominance of genes for earliness.

Complete genic dominance for early silking, partial to complete genic dominance for lower ear moisture at a uniform harvest period from planting, and variations from none to complete genic dominance for lower ear moisture fifty days after silking were indicated for the crosses. The data suggest that the classification of inbred lines entirely on the basis of silking date may not furnish the desired information on maturation.

Epistasis for earliness appeared to be exhibited by the dominant genes contributed by the early inbred R53 and possibly by A158. Inbreds containing dominant epistatic genes for earliness should provide more uniformity of maturity in a double cross of the type $(E_1 \times L_1) (E_2 \times L_2)$ than early inbreds with dominant but nonepistatic genes for earliness. Epistasis of dominant genes may aid in explaining reports that crosses of the type $(E_1 \times L_2) \times (E_2 \times L_2)$ were no more variable than that of the type $(E_1 \times L_2)$ and were no more variable than that of the type $(E_1 \times E_2) \times L_1 \times L_2$.

In the maturity studies, it could not be concluded whether gene action was following either the

arithmetic or the geometric schemes. In all cases where calculated means differed from the actual means, the geometric means were closed to agreement with the obtained.

Minimum gene numbers ranged from 5 to 19 for silking data, 2 to 11 for moisture content of ears harvested at a uniform period from planting, and from 1 to 54 for moisture content of ears harvested fifty days after silking.

Maximum heritability values ranged from 11 per cent to 48 per cent for silking date, 36 per cent to 58 per cent for moisture content of ears harvested at a uniform period from planting, and 22 per cent to 83 per cent for moisture content of ears harvested fifty days after silking. Heritabilities of ear moisture content averaged higher than heritability of silking date.

Considerable heterosis was exhibited for heavier ear weight in all crosses. Of the early inbred, R53 was exceptional in its contribution of favorable genes

for heavier ear weight. Genes affecting ear weight followed the arithmetic scheme.

Maximum heritability values calculated for ear weight indicated that very little, if any, progress could be expected from selection for heavy ears within the segregating progenies of any of the crosses at the uniform harvest period. However, good progress could be expected from selection with the F_2 generation of the crosses (MS206 x Oh 40B), (R53 x W23) and (A158 x W23) in the case of a harvest fifty days after silking.

It was proposed that an F_1 combination of early lines containing dominant epistatic genes with late lines possessing exceptional combining ability for yield may be made as follows: $((E_1 \times L_1) E_1) \times ((E_2 \times L_2) E_2)$.

Microfilm copy of complete manuscript of 140 pages, \$1.75. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-632.

BOTANY

EFFECTS OF BORON ON PECTINS AND OTHER CONSTITUENTS IN SUNFLOWER

(Publication No. 7183)

Paul Richard Ashworth, Ph.D.
University of Washington, 1953

Despite a century of investigations concerning the presence and importance of boron in plant tissues, its function is still unknown. Three hypotheses suggested in the literature have been investigated. They are: (1) that boron is functional in pectin synthesis, (2) that it is related in some way to the concentrations of sugars and starch, and (3) that it is involved in protein synthesis. The effects of boron concentration in the culture solution on the concentrations of four inorganic ions in sunflower tissue are also reported.

Sunflower plants (*Helianthus annuus*, variety Russian Mammoth) were grown in nutrient solutions containing varying concentrations of boron. In preliminary experiments the plants were grown in Mason jars and the visibly affected leaves of the deficient plants and leaves of the control plants comparable in position and age were used for the analyses. The results of the preliminary experiments were extremely variable. The nature of the boron deficiency symptoms seemed to indicate that the tips of the shoots were the best tissues to use for more critical experiments. Therefore tank culturing of sunflowers was undertaken to obtain enough tips for analysis.

The experiments did not solve the role of boron in the metabolism in higher plants, but the data

accumulated clearly demonstrated certain trends:

(1) Pectins were in higher concentration in deficient sunflower tissue than in normal tissue. (2) The concentrations of sugars and starch in the tips of sunflowers were not greatly affected by the boron level in the nutrient solution. (3) Boron had little effect on the concentrations of inorganic ions in plant tissues.

In addition there were indications that boron affects nitrate reduction or protein synthesis.

There is widespread acceptance of the hypothesis that boron is related to pectin synthesis, and some quantitative data and considerable histological data have been published in support of that idea. The results of these experiments are in contradiction to that hypothesis since more pectins were found in boron deficient tissue than in normal tissue.

Some investigators have reported higher amounts of reducing sugars, sucrose, and starch in boron deficient tissues than in normal tissues whereas others have reported little effect of boron on the content of sugars and starch. These experiments support the view that boron has little effect on the sugar and starch metabolism in sunflower.

Limited evidence has been presented that boron is functional in protein synthesis. This investigation lends some support to this hypothesis, but more intensive investigations are necessary before definite conclusions can be justified.

Evidence that boron is related to the uptake of calcium has been presented by workers, and some investigators have shown that the uptake of all the essential elements is affected by boron. Others,

including the present investigator, have found no consistent trends. It is believed that fluctuations in the concentration of inorganic constituents of plant tissues as affected by the boron concentration are relatively unimportant. These variations may be due to the species of plants used and the methods of experimentation.

It is also believed that the kind of gross analyses which were made in these experiments probably cannot solve the problem of the role of boron in plants. Suggestions for future research in various phases of the problem are discussed.

Microfilm copy of complete manuscript of 56 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-633.

ON THE MORPHOLOGY, ANATOMY, AND PHYLOGENY OF THE PSILOACEAE

(Publication No. 7276)

David William Bierhorst, Ph.D.
University of Minnesota, 1952

Included in this account are (i) anatomical and developmental studies with some cytological observations on the various stages of the life cycle of *Psilotum nudum* except those stages in the development of the gametophyte from the spore following the 2-celled stage; (ii) anatomical studies on the sporophytes of *P. complanatum*, *P. flaccidum*, and *Tmesipteris tannensis*; and (iii) developmental studies on the fructifications of *T. tannensis*.

The branching patterns of the gametophytes and sporophytic rhizomes and the discontinuous vascular strand in the gametophyte are described as resulting from mechanical injury and subsequent repair of the meristematic apices. All of the gametophytes are considered to be potential producers of a vascular strand.

A degree of regularity is ascribed to the divisions resulting in the development of the foot of the embryo. The young sporeling develops into a typical sporophytic rhizome. Most of the sporelings remain entirely underground and grow as saprophytes until they are no longer recognizable as sporelings.

The lower orders of ramifications in the aerial shoot of *P. nudum* are initiated almost simultaneously following the production of an "angle leaf" in the case of each bifurcation, or three "angle leaves" in the case of each trifurcation. The old apical cell loses its identity following bifurcation in the proximal part of the shoot system. Bifurcations in the distal portions of the system are separately initiated and probably involve the division of the old apical cell to form two new ones.

The sporophytes of *P. nudum* all had chromosome numbers of about 200, gametophytes about 100. No abnormal meiotic figures were observed. Abnormalities in the mitotic process are described in the shoot apices resulting in multinucleate cells.

Fertile appendages in *P. nudum* are described as originating by ontogenetic dichotomy of the apex of

the vegetative shoot. In both *Psilotum* and *Tmesipteris*, the fertile appendages grow by means of an apical cell which persists for a short period after the initiation of the primary archesporia in the spore-producing apparatus. The sterile apparatus (i.e., the "forked bract") originates from the abaxial side of the apex of the fertile appendage in a "leaf-like" manner. The archesporia are described as originating as the result of periclinal divisions in the surface layer just behind the apical cell of the fertile appendage. Dehiscence in the spore-producing apparatus is described as a relatively advanced type. A separate vascular trace is described for each of the three locules of the spore-producing apparatus in *P. nudum* and *P. complanatum*. In *Tmesipteris tannensis*, the vascular trace enters the base of the spore-producing apparatus where it divides into two, each of which runs up one edge of the septum separating the two locules. The third reduced trace previously described was completely absent.

Each locule of the spore-producing apparatus is interpreted as representing a separate sporangium on the basis of vascular anatomy. The continued presence and activity of the apical cell of the spore-producing apparatus after the initiation of the archesporia and also the presence of the third reduced vascular trace in the center of the septum in *Tmesipteris* (not present in the writer's material) is considered strong evidence for a central axis running up the center of the spore-producing apparatus. A modification of Sahni's "Verticillate Hypothesis" has been adopted by the writer. The fertile appendage of *Psilotum* accordingly would represent a central axis (much reduced) with a near-terminal verticil of three sporangia and a more proximal verticil of sterile appendages. A postulated ancestral type to the Psilotaceae fertile appendage might be represented by a branch with alternating verticils of sporangia and sterile appendages as is found in *Sphenophyllostachys verticillatum*. This interpretation, if correct, would indicate a possible relationship between the Psilotaceae and the Carboniferous Sphenophyllalean-Cheirostrobalean complex. The vegetative anatomy and morphology of *Psilotum* is discussed in terms of a possible articulate ancestry.

Microfilm copy of complete manuscript of 274 pages, \$3.43. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-634.

THE ADDITIVE AND ANTAGONISTIC EFFECTS OF VARIOUS GROWTH REGULATORS ON THE STRAIGHT GROWTH OF AVENA COLEOPTILES

(Publication No. 5459)

Arthur George Carroll, Ph.D.
State University of Iowa, 1953

This dissertation reports and analyzes the results of experiments concerned with: 1. The comparison of the effects of various regulators in promoting the straight growth of *Avena coleoptile*

sections; 2. The effects that sucrose and neutral salts have on the elongation of coleoptile sections when used alone and in combinations with various regulators; 3. The effects that various combinations of growth-promoting regulators have on the growth of sections; and 4. The effects that various combinations of growth-promoting and growth-inhibiting regulators have on the growth of sections.

Experiments have been reported in which the regulators employed here have been compared according to their capacity to promote the elongation of coleoptile sections. These experiments indicate that those regulators possessing a chemical structure which includes a reactive ortho position and a carboxyl group, or a group capable of being converted to or reacting as a carboxyl group, may cause growth. Other regulators have a similar chemical structure but differ from growth-promoting regulators in having a blocked ortho position. These regulators not only do not promote growth but also inhibit the growth promoted by other regulators.

It has been shown that regulators may be characterized by the differences in the initial and final growth induced during the entire growth period. These differences may be determined by measuring growth at frequent intervals during the period of the experiment. The differences that occur have been interpreted as being due to differences in affinity of the molecules of each compound in an enzyme-substrate association and a variation in the maximum reaction velocity for each compound. It has also been possible to determine by this procedure the presence of an initial period of reaction or transformation such as that postulated for certain benzoic acid derivatives.

Experiments conducted to determine the effects of sucrose, KCl and NaCl on the growth promoted by regulators have indicated that sucrose and KCl may contribute to growth by supplying metabolic factors that may be limiting. KCl may also increase growth by increasing the osmotic pressure. The effect of NaCl appears to be an effect on osmotic pressure alone.

In experiments conducted to determine the effects of combinations of growth-promoting regulators it was found that in no instance was the growth caused by two regulators equal to the sum of the growth caused by each regulator alone. In these experiments an additive effect may or may not occur. It was shown that the occurrence of an additive effect may depend upon the presence of sucrose and/or KCl when these factors are limiting. It was shown that the occurrence of an additive effect may also depend upon the relative concentrations of the regulators employed. It has been suggested that the growth that occurs in solutions of combined regulators depends upon: 1. The physiological condition of the sections; 2. The relative affinity of the molecules of each regulator for attachment at reactive sites; and 3. The relative growth activity of each regulator after attachment.

Experiments in which a growth-promoting regulator has been combined with a growth antagonist indicate that increasing concentrations of the antag-

onist, with a constant concentration of the growth-promoting regulator, cause increasing inhibition of growth. Increasing the concentration of the growth-promoting regulator with a constant concentration of the antagonist overcomes the inhibition. The Lineweaver-Burk modification of enzyme kinetic analysis applied to the data of other experiments has substantiated these concepts.

From the experiments of combined growth-promoting and growth-inhibiting regulators it has been suggested that: 1. That the growth-inhibiting regulators employed here differ from growth-promoting regulators in having a blocked ortho position; 2. That the competitive and reversible inhibition attributed to antagonists suggests that competition occurs between growth-promoting and growth-inhibiting regulators for the same site within the plant; and 3. That the blocked ortho position of the antagonist prevents a reaction in which another regulator through a two-point attachment, may cause growth.

Microfilm copy of complete manuscript of 104 pages, \$1.30. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-635.

THE FLORA OF SOUTHWESTERN IOWA

(Publication No. 5466)

Marcus Joseph Fay, Ph.D.
State University of Iowa, 1953

A taxonomic survey of the vascular plants of southwestern Iowa was made by the writer in order to obtain more adequate data on the flora of that region. The area considered in the investigation consists of approximately 8,500 square miles in the extreme southwestern corner of the state. For purposes of areal description, sixteen counties were chosen as the primary sphere of study, extending four tiers of counties east from the Missouri River and four tiers of counties north from the Iowa-Missouri state line.

Field exploration was started in August, 1951, and was carried on during the entire growing season of 1952. Over four thousand collections, totaling approximately ten thousand individual specimens, were made. These specimens serve as vouchers for those elements of the flora represented by collections. One complete set of the specimens will be retained in the Herbarium of the State University of Iowa.

Searches through the herbaria of the University of Iowa and of Iowa State College furnished data from specimens previously collected in or near southwestern Iowa. Additional information was obtained from the literature.

Brief descriptions of physiographic and climatic features of southwestern Iowa make up the introductory portion of the dissertation. Following these, plant communities are classified by habitat and described by listing characteristic and common plants found in each. The annotated catalogue of vascular

plants constitutes the major part of the dissertation; it includes frequency, distributional, and habitat data for each species.

The distribution of each species now known from southwestern Iowa is indicated on individual distribution maps. These maps are dispersed in appropriate positions throughout the annotated catalogue.

A statistical summary of the components of the flora follows the annotated catalogue. 111 families and 462 genera are represented. A total of 1,072 species are included in the flora.

Microfilm copy of complete manuscript of 507 pages, \$6.34. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-636.

AMMONIUM AND NITRATE NITROGEN IN NUTRITION OF TOMATO PLANTS ON PUMICE AND GRAVEL SUBSTRATES

(Publication No. 6515)

John Hacskeylo, Ph.D.
State University of Iowa, 1953

1. Tomato plants were grown on pumice and gravel substrates and supplied with nutrient solutions of uniform nitrogen levels, but varied in the proportion of NO_3 and NH_4 ion to determine the differences in growth response, development and tissue composition on a given substrate.

2. Floral primordia were initiated at the 11th node irrespective to substrate and type of nitrogen supplied. The time of floral initiation was influenced by the available NH_4 -N on gravel but not a pumice substrate. Anthesis was delayed in both gravel and pumice in direct relation to the NH_4 -N supplied, but the retardation was greater in the gravel series.

3. The total stem height, weekly rates of elongation, visible nodes, floral clusters formed, fruits set and wet and dry weight yields were generally higher in the pumice series and showed no appreciable variation between series in respect to the pH of nitrogen supplied; however, in the gravel series there was an inverse relationship to the NH_4 -N supply and acidity of the residual nutrient solution with the exception of leaf abscission which increased as the pH decreased.

4. Toxicity of the nutrient solution to the plants on gravel increases as NH_4 -N supply increases, resulting in dwarfed, spindly, chlorotic plants with poorly developed root systems. The plants on pumice were vigorous and healthy with well developed root systems irrespective of the type of nitrogen supplied and low pH values in the high NH_4 -N series.

5. The total uptake of NO_3 -N or NH_4 -N based on analysis of the residual nutrient solutions and the total accumulation of potassium, calcium, magnesium, nitrogen and carbohydrate reserve as determined by tissue analysis of the plants in the pumice series exceeded that of the plants grown in the gravel series which varied inversely with the NH_4 -N supply and directly with the pH of the residual nutrient solutions.

6. The low accumulation of calcium, magnesium and potassium in the high NH_4 -N series by plants on gravel as compared to the higher accumulations in the comparable series in pumice indicate that these ions may be limiting factors in the growth and development of the tomato plants grown in a gravel substrate.

7. Pumice was found to be an added source of nutrition; base for ionic exchange; indications of having the qualities of a buffer system; and suggestions of having a contact catalytic effect on the development of extensive root systems.

8. It was found that pumice was a superior substrate on which to grow tomato plants as compared to a gravel substrate when the same nutrition was supplied. Plants grew equally well when supplied with either 100% NH_4 -N at lower pH levels or 100% NO_3 -N when the residual culture solution was slightly acid and on a pumice substrate.

Microfilm copy of complete manuscript of 54 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-637.

STUDIES ON SOME LIGHT ACTIVATED PROCESSES IN RHODOSPIRILLUM RUBRUM

(Publication No. 7239)

James Alexander Johnston, Ph.D.
University of Minnesota, 1953

The effect of light upon several metabolic processes occurring in Rhodospirillum rubrum has been reinvestigated. Photoproduction of hydrogen with malate present as a substrate was compared with photoreduction of carbon dioxide in the presence of molecular hydrogen as a function of light intensity and of inhibitor concentrations. It was found that photoproduction was more sensitive to 2,4 dinitrophenol, hydroxylamine, and o-phenanthroline than was photoreduction. An analysis of the action of the inhibitors together with other lines of evidence indicated that photoproduction and photoreduction normally occurred simultaneously. It was also found that this organism could, when properly adapted, produce molecular hydrogen and carbon dioxide at an appreciable rate in the absence of an exogenous substrate.

The effect of illumination upon the rate of uptake of oxygen isotopes by R. rubrum was studied manometrically and also with the use of heavy oxygen in the gas phase. The rate of oxygen consumption was decreased by light. This phenomenon, previously reported by van Niel on the basis of indirect evidence, now is confirmed by an unequivocal method. It was further demonstrated that no molecular oxygen was produced in the light by R. rubrum. Therefore, the light effect upon respiration was in fact a photoinhibition of oxygen consumption. In general however, illumination did not completely inhibit oxygen consumption.

A scheme by means of which the several photo-reactions of *R. rubrum* and the action of inhibitors thereon may be rationalized and related was presented and discussed.

Microfilm copy of complete manuscript of 81 pages, \$1.01. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-638.

A STUDY OF CARBONIC ANHYDRASE IN PLANTS

(Publication No. 7471)

Eugene Hans Lucas, Ph.D.
Michigan State College, 1952

Soon after the discovery of the enzyme carbonic anhydrase in red blood cells in 1932 a search for a similar enzyme in plants was undertaken by a number of investigators. Until 1946 several publications appeared which disagreed among each other concerning the evidence of presence of such an enzyme in plants. Early in 1947 independent work at Oxford University and at Michigan State College led to the establishment of evidence of the presence in most green plants tested of an enzyme with carbonic anhydrase characteristics. The Oxford findings were published in 1947, the work at East Lansing was first reported at the annual meeting of the Michigan Academy of Science, Arts, and Letters in 1948.

During the following years the distribution of this enzyme in green plants and its properties were studied extensively. It was found that the enzyme is a regular constituent of the leaf tissues of green plants where it occurs in varying amounts. Some plants contain a high concentration of the enzyme in leaf extracts, others less. Only five out of 47 species investigated did not give any evidence of the presence of the enzyme. It is considered likely that shortcomings of technique were responsible for the failure to demonstrate the enzyme in these species. Leaves of the plants tested contained the enzyme in varying amounts according to their position on the plants; the greatest amounts were found in fully developed leaves. Meristematic tissues always showed evidence of increased enzyme activity. Green parts other than leaf tissues contained varying, but always minute, amounts of the enzyme. Some flower extracts produced an activity which indicated the presence of the enzyme but roots were always devoid of it.

In vitro studies of the kinetics of the enzyme showed that it catalyzed the dehydration of carbonic acid as well as the hydration of carbon dioxide. It is this latter reaction which had led to speculations about the participation of the enzyme in a phase of the photosynthetic process. The kinetic studies which demonstrated dependence of the enzyme action on hydrogen ion concentration, temperature and substrate concentration produced a similarity with photosynthetic requirements insofar as both reactions take place within the same pH ranges (6.0 to 8.0); their temperature coefficients vary between 1.0 and

2.0 depending on the temperature range used for the calculation; and they cease to take place at temperatures above 50° C.

The enzyme is inhibited by cyanide which also inhibits CO₂ fixation in photosynthesis. Other inhibitors which have been shown to affect the animal enzyme, as sulfanilamide, did not have marked effect on the enzyme activity *in vitro*. No interference with the enzyme activity by 2,4-dichlorophenoxyacetic acid was observed.

It was possible to purify the enzyme although its sensitivity to exposure to air and temperatures above 15° C is considerable and increases with its state of purification. Chromatographic adsorption of an aqueous extract digested with papain produced a fraction of high enzyme activity having considerable stability when stored at low temperature.

Microfilm copy of complete manuscript of 116 pages, \$1.45. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-639.

PHYSIOLOGY OF ENDOCONIDIOPHORA FAGACEARUM, THE FUNGUS CAUSING OAK WILT, WITH SPECIAL REFERENCE TO GROWTH AND TOXIN PRODUCTION IN SYNTHETIC MEDIA

(Publication No. 7177)

Irene Ginsberg White, Ph.D.
Vanderbilt University, 1953

Supervisor: Professor F. T. Wolf

This study is concerned with the nutrition and growth in synthetic media of *Endoconidiophora fagacearum* (Henry) Bretz, the fungus which causes oak wilt. It is also concerned with the physiology of toxin production, and the properties of the toxin, by means of which the symptoms characteristic of the disease are produced.

The optimal pH for growth of *E. fagacearum*, which was studied using two different media and three strains of the organism, was found to be approximately pH 3.0-4.5. Of 22 carbon compounds tested as sole sources of carbon, cellobiose, levulose, glucose, xylose, starch or dextrin were found to be excellent carbon sources; maltose, galactose, trehalose, mannose, raffinose or glycerol were good; sucrose, sorbitol, mannitol or melizitose were fair; and essentially no growth resulted when inositol, sorbose, lactose, melibiose, rhamnose or arabinose were tested. This organism is unable to utilize nitrate nitrogen, but utilizes ammonium or amino nitrogen for growth. Of 24 amino acids tested as sole sources of nitrogen for the growth of *E. fagacearum*, ornithine, HCl, aspartic acid, glutamic acid, arginine, HCl or alanine were the best nitrogen sources; proline, glycine, isoleucine, methionine, tryptophane, serine, leucine or phenylalanine were fair. The fungus were unable to grow to any considerable degree upon tyrosine, lysine. HCl,

hydroxyproline, cysteine.HCl, threonine, histidine. HCl, β -alanine or cystine.

The glucose level for optimal growth in stationary culture was approximately 10 per cent. Good growth was obtained, however, with the range of glucose concentration of 1-16 per cent. A concentration of 0.2 per cent asparagine proved to be optimal for growth in stationary cultures, good growth taking place within a concentration of 0.03-0.4 per cent. *E. fagacearum* has no absolute vitamin requirement for growth. Inositol, pyridoxine and pteroylglutamic acid were found to have a stimulatory effect on the growth of the organism. The pathogen has a low temperature requirement, with a maximum temperature for growth being 27°C.

E. fagacearum is capable of secreting a substance or substances into the culture medium which produce wilting symptoms in oak leaves. Differences in toxin producing ability were found to occur among the three strains tested. Filtrates of strain OW-25 grown in shake culture for 28 days produced wilting symptoms when the culture filtrate was diluted tenfold.

The interrelations among growth, pH, glucose utilization and toxin production were studied comparatively in shake and stationary cultures, in a medium containing 2.5 per cent glucose and 0.2 per cent asparagine. Growth obtained in shake cultures was greatly in excess of that found in cultures incubated under stationary conditions. The more rapid growth in shake culture was accompanied by a corresponding increase in glucose utilization, growth reaching a maximum at 28 days in shake cultures concomitantly with the exhaustion of glucose. Growth in shake culture is accompanied by rise in pH, which remains essentially unchanged in quiet culture. Determinations of the economic coefficient indicate a value approximately twice as high in shake as in stationary cultures. Toxin production becomes evi-

dent earlier in shake cultures than in stationary, and higher titers are produced.

The toxin is apparently unaffected by pH within the range 2.5-9.0. It is non-volatile and heat stable under the conditions tested. The toxic principles are adsorbed by charcoal, and cannot be removed from it by treatment with benzene or dilute hydrochloric acid. The toxin produced in shake culture is composed of at least two components, which may be separated by precipitation with alcohol. The alcohol-insoluble precipitate produces a portion of the wilting syndrome, namely, drying of oak leaves. The substance responsible for this portion of the symptom complex is non-dialyzable. The production from the alcohol-insoluble precipitate by acid hydrolysis of a substance which reduces Fehling's solution and which forms an osazone suggests that this material is a polysaccharide. Data are presented concerning the amounts of polysaccharide formed in culture filtrates during growth of *E. fagacearum* and are correlated with the production of wilting symptoms by the filtrates.

The component present in the alcohol-soluble fraction is responsible for the production of dark necrotic areas.

Evidence is presented for the production of melanin by *E. fagacearum*. Conditions of relative humidity under which wilting tests are performed influence the rapidity with which wilting symptoms appear, high relative humidity resulting in a delay in the appearance of wilting symptoms.

Microfilm copy of complete manuscript of 131 pages, \$1.64. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-640.

CHEMISTRY

CHEMISTRY, GENERAL

A CRITICAL STUDY OF THE CHROMATOGRAPHIC SEPARATION OF CALCIFEROL FROM ERGOSTEROL

(Publication No. 7476)

Jean Bullard Burnett, Ph.D.
Michigan State College, 1952

The chromatographic separation of synthetic mixtures of pure calciferol from pure ergosterol has been accomplished by using an ether or ether - hexane solvent and an alumina or superfiltrol adsorbent. Ether was found to be the best solvent and eluent for the accomplishment of the separation by means of an alumina adsorbent. When superfiltrol was used as the adsorbent, ether - hexane in the ratio of 1:5 parts by volume was found to be a very satisfactory solvent for the separation.

In obtaining a complete separation of the two compounds, the weight of the adsorbent and the height to which it was packed in the chromatographic tube were very important. Alumina gave a very good separation of the two compounds, the resultant form of each being pure and free from any other material. However, the lengthening of the column and the resulting broader banding of each compound within the column were found to be undesirable. Superfiltrol gave a very sharp separation much more quickly and on a very much shorter column. However, a conversion of the ergosterol into two irrelevant substances took place on the adsorbent and, while calciferol and ergosterol were obtained free from each other, neither compound was found in the eluate completely free from one or both of the irrelevant materials. This observation lead to a pattern analysis of the conversion products and as a result, the eluate fractions could be analyzed by a system of simultaneous linear equations. Also, the concentration of calciferol or ergosterol in the total eluate, or any fraction thereof, could be determined exactly.

The relative and total concentrations of calciferol and ergosterol initially placed on either adsorbent had very little effect on the total calciferol recovery. However, both the separation of the two compounds and the total ergosterol recovery were influenced considerably by this property.

Microfilm copy of complete manuscript of 79 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-641.

THE KINETICS OF THE GALLIUM CHLORIDE CATALYZED ADDITION OF HYDROGEN CHLORIDE TO OLEFINS¹

(Publication No. 7522)

Martha Ellen Havill, Ph.D.
Purdue University, 1954

The kinetics of the gallium chloride catalyzed addition of hydrogen chloride to olefins has been found to be first order in respect to hydrogen chloride and gallium chloride. The mechanism of the reaction has been considered and the reaction of gallium chloride with an olefin-hydrogen chloride π -complex proposed as an important and possibly rate-determining step. The relative reactivities of the olefins investigated were cyclohexene > cyclopentene >> cis-dichloroethylene > trichloroethylene >> trans-dichloroethylene, tetrachloroethylene. Except for trans-dichloroethylene the relative reactivities observed are in the same order as the relative basicities of the olefins as determined by the stabilities of the olefin-hydrogen chloride π -complexes.

1. The Metallic Halides

Microfilm copy of complete manuscript of 143 pages, \$1.79. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-642.

A STUDY OF SOME COMPLEXES OF THE GROUP III AND GROUP V HALIDES

(Publication No. 7523)

Robert Richard Holmes, Ph.D.
Purdue University, 1954

The heats of reaction of 2-, 3- and 4-alkylpyridines containing the alkyl groups, methyl, ethyl, isopropyl and t-butyl, as well as 2,6-lutidine and triethylamine, were measured calorimetrically. Parallelisms were found between the heats of reaction and acidity constants which held for ortho, as well as the meta and para derivatives. It was found that this type of parallelism would be obtained when the steric requirements of the reference acid were similar in two series of reactions being compared.

Substitution of methyl, ethyl, isopropyl and t-butyl groups in the 2-, 3- and 4 position of pyridine produced variations in their heats of reaction with methanesulfonic acid which were in complete accord with the inductive effect of the alkyl groups.

The molar heats of reaction of pyridine with boron trifluoride, boron trichloride and boron tribromide were measured in nitrobenzene solution, using a

calorimetric procedure. The heats of reaction of the boron halides with nitrobenzene were also measured, calorimetrically in the case of boron trichloride and bromide and from Henry's law constant determinations in the case of boron trifluoride. From the above data the relative bond dissociation energies of the pyridine-boron trihalide complexes were calculated, giving therefore a measure of the strengths of the boron trihalides as Lewis acids. The strengths fell in the order: boron tribromide greater than boron trichloride greater than boron trifluoride. The results were explained on the basis of the resonance picture with boron trifluoride having the most contributing forms.

Finally, the addition compounds of the boron trihalides with pyridine and nitrobenzene were isolated and characterized with the exception of nitrobenzene-boron trifluoride. All were 1:1 complexes.

A remarkable series of complexes formed between phosphorus pentachloride and the Group III trichlorides, having the general formula $PMCl_8$ where M represents either B, Al or Ga. Various preparative procedures were developed. These compounds have unusually high melting points and low volatility. Their properties indicate that their structure is of an ionic nature, postulated to be $PCl_4 + MCl_4$. No evidence for a corresponding series with arsenic and antimony was obtained.

The 1:1 addition compounds between pyridine and phosphorus and antimony pentachloride were prepared. No evidence was obtained for the existence of a similar complex between the unknown arsenic pentachloride and pyridine.

Thus, evidence was presented confirming the ability of phosphorus and antimony pentachlorides to act as Lewis acids, as well as forming complexes of an ionic nature.

Microfilm copy of complete manuscript of 191 pages, \$2.39. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-643.

A STUDY OF THE REACTION OF CELLULOSE NITRATE WITH VARIOUS REDUCING AGENTS

(Publication No. 6566)

Frank John Masuelli, Ph.D.
Virginia Polytechnic Institute, 1953

Cellulose nitrate does not react with diphenyl or diethyl zinc dissolved in toluene, nor does it react with diethyl tin in liquid ammonia solution. In the latter case the cellulose nitrate is converted to cellulose amine by the ammonolytic effect of the ammonia.

Powdered sodium borohydride added to a dilute solution of cellulose nitrate in acetone causes immediate gelation of the ester. The gel is presumed to be formed by the reaction of the hydride with the nitrate groups of cellulose nitrate. Hydrolysis of the complex with water or glacial acetic acid yields a boron and nitrogen free derivative the nature of which is unknown.

Cellulose nitrate reacts with ammonia either in the gaseous or liquid state to form cellulose monoamine. The mechanism of the process is the same in all reactions and is independent of the experimental conditions. When the reaction is carried out in the presence of ammonio bases such as sodium amide the cellulose amine is considerably degraded and is soluble in water; in all other cases the amine is water insoluble.

Cellulose amine in glacial acetic acid solution may be diazotized and coupled with aromatic intermediates to form stable mono-azo derivatives whose properties are independent of the physical properties of the amine. Cellulose amine is deaminated by the action of hypophosphorous acid on the cellulose diazotium salt to a desoxy cellulose containing between one and two per cent amino nitrogen. Several theories are advanced to account for the fact that complete deamination is not realized.

The reaction between cellulose nitrate and di-n-butyl amine yields a cellulose di-n-butyl amine of degree of substitution between one and two. The mechanism of the reaction is presumed to be the same as that for the formation of cellulose amine. The cellulose di-n-butyl amine could not be dealkylated.

Microfilm copy of complete manuscript of 221 pages, \$2.76. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-644.

SULFONATION OF KETONES OF SINGULAR STRUCTURE

(Publication No. 7524)

Peter T. Mori, Ph.D.
Purdue University, 1954

Until recently (1), very few reports have appeared in the literature on the direct sulfonation of ketones in which the reaction products have been isolated and identified (2-6). Hence, the reaction of dioxane sulfur trioxide with several ketones of singular structure has been studied.

α -Chloroacetophenone reacts with dioxane sulfur trioxide to give α -chloroacetophenone- α -sulfonic acid in good yield. Similarly α -fluoroacetophenone, *m*-diacetylbenzene and *p*-diacetylbenzene were converted by this reagent to α -fluoroacetophenone- α -sulfonic acid, *m*-diacetylbenzene- α, α -disulfonic acid and *p*-diacetylbenzene- α, α' -disulfonic acid respectively.

The structures of the sulfonic acids obtained from the diacetylbenzenes were established by comparing their S-benzylthiuronium salts with authentic samples. Authentic samples of the sulfonic acids were synthesized by a Strecker reaction on the corresponding α, α' -dibromoketones. The structures of the sulfonic acids obtained from the phenacyl halides were established by oxidation (7) to benzoic acid and by the preparation and analysis of S-benzylthiuronium salts. Furthermore, aqueous sodium hydroxide cleaved

(1) the sulfonation products obtained from α -chloro- and α -fluoroacetophenone to benzoic acid and unidentified sulfur-containing material. An attempt to synthesize α -chloroacetophenone- α -sulfonic acid by the chlorination of acetophenone- α -sulfonic acid resulted in decomposition.

γ -Diacetylbenzene with the sulfur trioxide complexes of dioxane and pyridine (8), and dibenzoyl methane with the former reagent, gave green colorations but no identifiable sulfonates. In the latter case, hydrolysis of the reaction mixture gave back dibenzoyl methane. An attempt to prepare a salt of the postulated intermediate enol sulfate with triethylamine did not succeed.

When ethyl *p*-acetyl- α -toluate was added to dioxane sulfur trioxide, a disulfonic acid was obtained. Alkaline permanganate oxidation of the sodium sulfonate gave terephthalic acid, and the *S*-benzylthiuronium derivative analyzed correctly for the disulfonate. An attempt to prepare *p*-(ClCH₂CO)C₆H₄CHBrCO₂Et, by chloroacetylating the bromoester, and for use in a contemplated Strecker synthesis of the corresponding sulfonate, was unsuccessful.

Since nitroparaffins enolize easily, it was thought that they might react with dioxane sulfur trioxide similarly as ketones. Nitromethane and 2-nitropropane formed highly-water soluble compounds with this reagent. However, a crystalline sodium or *S*-benzylthiuronium sulfonate could not be isolated.

REFERENCES

1. Truce and Alfieri, *J. Am. Chem. Soc.*, **72**, 2740 (1950).
2. Doering and Beringer, *J. Am. Chem. Soc.*, **71**, 2221 (1949).
3. Weston and Suter, *J. Am. Chem. Soc.*, **61**, 389 (1938).
4. Krekeler, *Ber.*, **19**, 676, 2627 (1886).
5. Suter, *Organic Chemistry of Sulfur*, John Wiley and Sons, Inc., New York, N. Y., 1944, pp. 139, 316.
6. Ioffe and Naumova, *J. Gen. Chem.*, **9**, 1121 (1939).
7. Shriner and Fuson, *The Systematic Identification of Organic Compounds*, 3rd Ed., John Wiley and Sons, Inc., New York, N. Y., 1948, p. 198.
8. Terentev and Dombrovskii, *J. Gen. Chem.*, **19**, 1467 (1949).

Microfilm copy of complete manuscript of 70 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-645.

VOLUMETRIC BEHAVIOR OF THE METHANOL-*n*-BUTANE SYSTEM

(Publication No. 7525)

Leonard Beck Petty, Ph.D.
Purdue University, 1954

Experimental data are presented for the vapor-phase volumetric behavior of methanol, *n*-butane, and three mixtures of these materials (25, 50, and 75 mole per cent *n*-butane) at temperatures of 120, 160, 200,

240, and 280°F. at pressures up to the saturation pressure in each case. Volumetric data are also presented for the saturated liquids of the same compositions and at the same temperatures.

A variable-volume apparatus was used, and volumes were determined by measuring the resistance of a calibrated loop of platinum-iridium wire suspended in a compressibility bomb in which the sample was confined by mercury. Pressures were measured with a dead-weight gauge. The apparatus was immersed in an oil bath, the temperature of which was controlled to within 0.05°F.

The data for *n*-butane are in excellent agreement with the accepted values for this material, the average deviation being about 0.20%. The data for methanol agree only moderately well with those of Ramsey and Young taken many years ago. The results are believed to be accurate to within about 0.3% in most cases.

Attempts were made to obtain data at temperatures above 280°F., but these were frustrated by resistance changes in the platinum-iridium wire caused by mercury attack. At temperatures below 280°F. this attack was not serious, and below 240°F. it was negligible. Suggestions are made for obviating these difficulties at high temperatures by a modification of the apparatus.

Compressibility factors, residual volumes, and partial molal volumes were calculated from the data, and smoothed values of these properties are presented in tables and graphs. The variations of these properties with composition have not been established as well as was expected since the system behaves in an unusual manner and the compositions investigated are widely separated. On the other hand the variations with temperature and pressure have been well established over the range of conditions covered.

Microfilm copy of complete manuscript of 164 pages, \$2.05. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-646.

BENZO-1, 4-DITHIADIENE

(Publication No. 7292)

Thomas Michael Roder, Ph.D.
University of Minnesota, 1952

In 1890, Levi¹ reported certain similarities in properties of 1,4-dithiadiene (I) to thiophene and benzene, and suggested that the former is aromatic in character. The conclusion that 1,4-dithiadiene



(I)

is aromatic was based primarily on the fact that the system was found to undergo the Friedel-Crafts reaction. The Friedel-Crafts reaction can hardly be

considered, in itself, an index to aromatic character; however, the successful application of this reaction to 1,4-dithiadiene assumes added significance when one considers the usual susceptibility of vinyl ethers and vinyl sulfides to polymerization in the presence of Lewis acids.

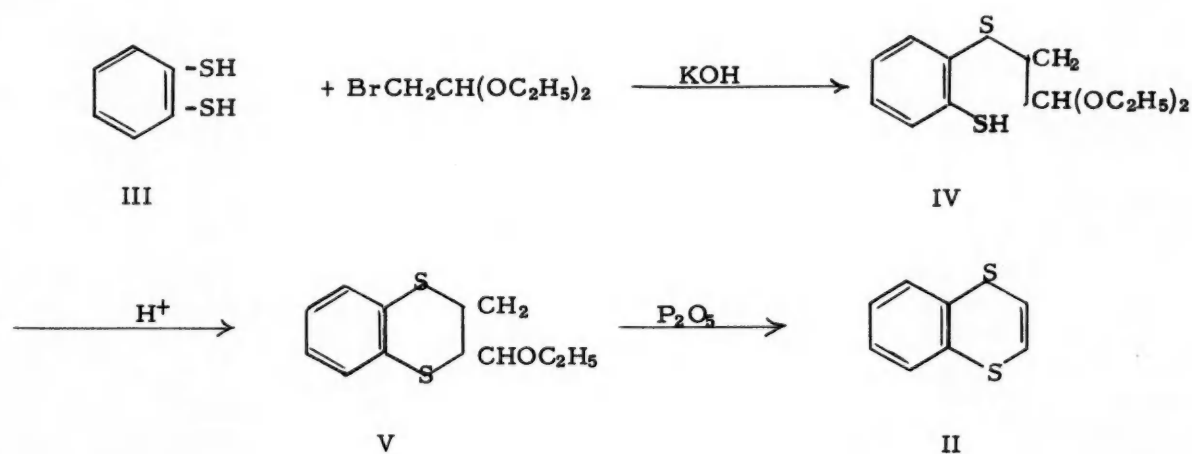
Attempts to prepare 1,4-dithiadiene by Levi's procedure have been unsuccessful, and with the exception of the reported synthesis of 1,4-dithiadiene, no compound containing this ring system with unsubstituted adjacent alpha and beta positions has been reported. The purpose of this research was to develop a synthesis of such compounds, which would be suitable for an investigation of the chemical and physical nature of the 1,4-dithiadiene ring.

of II and to obtain some information concerning the chemical and physical nature of the 1,4-dithiadiene ring.

The structure of II was established by reduction to benzo-1,4-dithiane (VI), which was synthesized independently from dithiocatechol and ethylene bromide. Benzo-1,4-dithiane was characterized by oxidation to the solid disulfone VIII.

Oxidation of benzo-1,4-dithiadiene to benzo-1,4-dithiadiene disulfone (VII) was accomplished with hydrogen peroxide. The structure of the disulfone VII was established by reduction to benzo-1,4-dithiane disulfone (VIII).

Benzo-1,4-dithiadiene was also synthesized by the low temperature dehydrogenation of benzo-1,4-dithiane

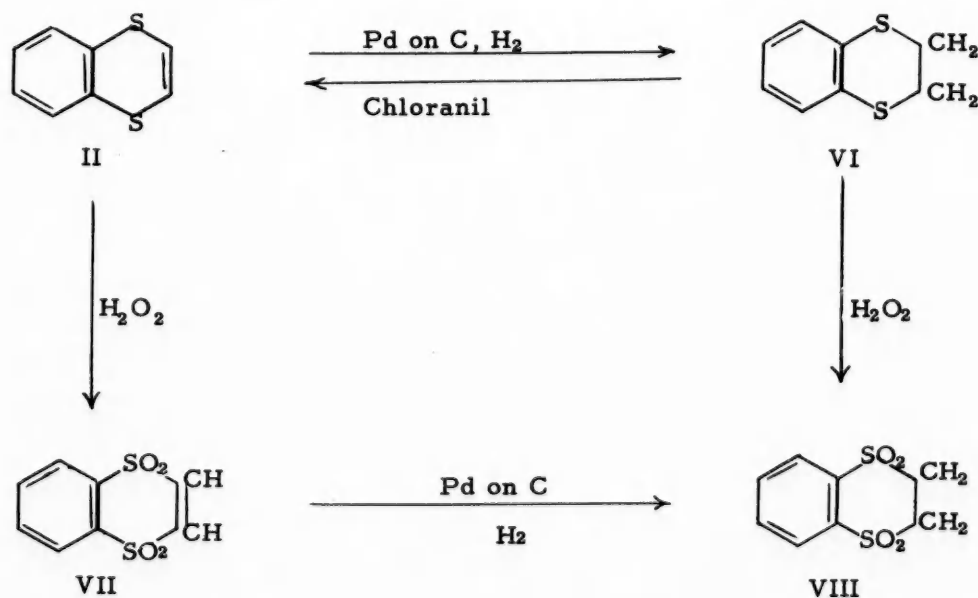


Benzo-1,4-dithiadiene (II) was synthesized by the scheme outlined in the above equations. Dithiocatechol (III) was alkylated with diethyl bromoacetate, and the product of this reaction IV was treated with acid to obtain 2-ethoxybenzo-1,4-dithiadiene (V). Benzo-1,4-dithiadiene (II) was prepared from the cyclic acetal V by heating with phosphorus pentoxide.

with chloranil. The success of this synthesis strongly suggested that benzo-1,4-dithiadiene possesses aromatic character.

Other reactions and physical properties of benzo-1,4-dithiadiene were investigated in this research.

1. L. E. Levi, Chem. News, 62, 216 (1890).



A number of reactions of benzo-1,4-dithiadiene and related compounds were studied to prove the structure

Microfilm copy of complete manuscript of 108 pages, \$1.35. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-647.

**I. THE CHROMATOGRAPHIC SEPARATION
AND THE DETERMINATION OF
VITAMIN D₂ IN CORN OIL.**

**II. THE CHROMATOGRAPHIC SEPARATION
AND THE DETERMINATION OF VITAMINS D
IN VARIOUS OILS CONTAINING VITAMIN A**

(Publication No. 7479)

Tom Daniel Schlabach, Jr., Ph.D.
Michigan State College, 1952

The difficulties and limitations associated with the available physico-chemical methods for the determination of vitamins D in various oils, especially in samples containing small amounts of vitamins D, led to the present investigation.

Two methods are proposed; the first for the determination of vitamin D₂, present as an irradiated ergosterol, in corn oil, and the second for the determination of vitamins D in various oils containing vitamin A.

The methods proposed utilize a two-step chromatographic process for the separation of vitamin D from the other non-saponifiable oil constituents. In the first step an activated earth, Superfiltrol, is used to remove vitamin A, carotenoids, pigments, and some sterols. In the second step an activated alumina is used to remove vitamin A decomposition product (s), certain polyenes, and other residues from the oil and the Superfiltrol adsorbent itself. The vitamin D is ultimately determined by utilizing its absorption maximum at 265 mμ as a measure of the amount present.

The first method has been successfully applied to samples of vitamin D₂, present as an irradiated ergosterol, in corn oil containing as little as 4000 U.S.P. units of vitamin D₂ per gram of oil. The second method has been successfully applied to samples of vitamins D in a variety of oils containing as little as 4000 U.S.P. units of vitamin D per gram, and where the vitamin A to D ratio does not exceed ten to one.

The chromatographic behavior of vitamin D₂, vitamin A, ergosterol, cholesterol, the non-saponifiable fraction of corn oil, and various fish liver oils have been extensively studied on both adsorbents.

Microfilm copy of complete manuscript of 75 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-648.

**STUDIES IN VAPOR-PHASE
ESTERIFICATION**

(Publication No. 7295)

Michael Stusiak, Ph.D.
University of Minnesota, 1952

Acetic acid and ethyl alcohol were esterified in the vapor-phase with tungstic oxide carried on alumina balls. The reaction was carried out in a continuous-flow, packed tubular reactor and kinetic data were obtained at 140°C., 160°C. and 180°C., with most of the data being for 160°C. and 0.972 atm. The data showed that a surface reaction was the rate-controlling step.

A mechanism was postulated and a rate equation based on the mechanism was established using the methods of Hougen and Watson. The equation at 160°C. was

$$r = 0.0123 \frac{(p_A p_B - \frac{p_R p_S}{K})}{(1 + 3.327 p_A + 1.075 p_S)^2}$$

and reproduced the data quite well at this temperature.

The data showed and the assumption was made that the reaction approximated a pseudo-first-order relationship when only the feed rate was varied. Using this simplification equations were derived relating diffusion and chemical reaction within a particle of catalyst. Intraparticle diffusion was not an important factor in determining the rate of the over-all reaction. First order velocity constants were calculated at 140°C., 160°C. and 180°C. A linear relationship was not obtained when the logarithm of the velocity constant was plotted against the reciprocal of the absolute temperature. However, the slope of the best straight line yielded an activation energy of 10,320 cal./g.mole.

Equations for a continuous-flow, packed tubular reactor were compared with those for a continuous-flow, well-agitated reactor. The comparison showed that for a given system and catalyst the behavior of one of the reactors can be predicted if the behavior of the other is known.

Microfilm copy of complete manuscript of 214 pages, \$2.68. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-649.

**STUDIES IN MOLECULAR STRUCTURE:
THE RAMAN AND INFRARED SPECTRA OF
THE SERIES (CH₃)_x SnCl_(4-x)**

(Publication No. 7527)

Curtis H. Ward, Ph.D.
Purdue University, 1954

The Raman and infrared spectra of CH₃SnCl₃, (CH₃)₂SnCl₂, (CH₃)₃SnCl, and Sn(CH₃)₄ were observed. For each molecule studied, the observed frequencies were assigned to the fundamental modes of vibration or to combinations, differences, and overtones of the fundamental frequencies. Key features of the frequency assignments for the molecules of this series are the apparent decoupling of CH₃ group vibrations, the coincidence of Sn-C stretching vibrations, and the piling up of low lying fundamentals. The results for this series of tin compounds have been compared to the results for the corresponding carbon and silicon series.

Microfilm copy of complete manuscript of 272 pages, \$3.40. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-650.

**THE ULTRAVIOLET IRRADIATION OF
CALCIFEROL IN VARIOUS SOLVENTS**

(Publication No. 7481)

Robert Yates, Ph.D.
Michigan State College, 1952

The irradiation of calciferol has been studied to some extent previously but the reactions involved and their relationships have not been completely elucidated. This investigation was undertaken to study these reactions and their relationships and to determine the effects of wavelength of irradiating energy and solvent on the reactions.

The irradiations were conducted in ethanol, n-hexane and a mixture of n-hexane and ethyl ether using several lines of the mercury spectrum. The absorption spectra of the irradiated solutions were measured at various time intervals and the compositions of the mixtures were estimated on the basis of absorption spectra data.

Evidence was obtained for the presence of a substance which has a spectrum similar to protachysterol which has not previously been reported in the irradiated calciferol solutions. This substance appeared to be formed simultaneously with toxisterol and the suprasterols and to react photochemically after its formation.

The nature of the solvent appeared to have no effect on these reactions. The wavelength of irradiating light appeared to have no effect on the course of the reactions, although the rate of conversion of calciferol varied to some extent.

Microfilm copy of complete manuscript of 78 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-651.

CHEMISTRY, BIOLOGICAL**STUDIES OF THE PHYSICAL PROPERTIES
OF SOME BULK LAXATIVES**

(Publication No. 7185)

Jack Norman Bone, Ph.D.
University of Washington, 1953

The swelling properties and the textures of the masses formed have been studied and described for 24 bulk laxatives now on the market. These bulk laxatives were selected to represent the tragacanth, the psyllium, the methylcellulose and the carob type bases. Their properties were observed in distilled water, 2% sodium chloride solution, 0.5% hydrochloric acid solution, 1% sodium bicarbonate solution, artificial gastric juice and artificial intestinal juice.

The swelling properties of the carob group were not influenced to any extent by the different types of suspending liquids used. Their volumes increased from 5-10 times in 24 hours with most of the swelling

taking place during the first hour. The methylcellulose tablets showed the least disintegration and increase in swelling in the distilled water, 5-11 times in 24 hours, but in the other suspending liquids used the tablets disintegrated much better and as a result swelled from 12-30 times in the NaCl and alkaline solutions and 6-18 times in the acid solutions. The methylcellulose tablet preparations swelled gradually over the 24 hour period.

With the tragacanth group the swelling was influenced by the type of suspending liquid used. The most swelling occurred in the distilled water, from 20-44 times the original volume in 24 hours. The mass volumes were about one-half as great in the alkaline solutions as in the distilled water. They were still smaller in the other liquids used. These preparations swelled gradually over the 24 hour period.

With the psyllium group the swelling was not influenced to any extent by the different types of suspending liquids used except those marketed in a powdered or fine flake form. The granular forms swelled approximately 7 times in all the liquids. The powdered or fine flake form swelled approximately 15 times in distilled water and 10 times in the other liquids. These preparations did most of their swelling during the first hour.

Members of the carob group and the methylcellulose group in tablet form produced gummy masses; those of the tragacanth group produced masses consisting of gelatinous particles; those of the psyllium group marketed in a powdered or fine flake form produced granular, mucilaginous masses and those marketed in a granular form produced jelly-like, rubbery masses.

The second part of this study was made to determine if the bulk-type laxatives now commercially available would absorb or entrap common food principles representing salt, protein, carbohydrate and fat. The results indicated that many of the bulk-type laxatives studied absorbed or entrapped common food principles or at least retarded their diffusion through a semipermeable membrane.

The third part of this study was made to determine if the presence of the bulk-type laxatives would influence the digestion of a carbohydrate, a fat and a protein. The results indicated that in the presence of the bulk-type laxatives the digestion of a carbohydrate and a protein was retarded and the digestion of a fat accelerated.

Microfilm copy of complete manuscript of 135 pages, \$1.69. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-652.

A STUDY OF INVERTASE

(Publication No. 7277)

Joseph Anthony Cifonelli, Ph.D.
University of Minnesota, 1952

Invertase preparations as ordinarily obtained contain varying amounts of both carbohydrate and inactive protein. Methods were developed which removed

inactive protein. Chloroform extraction was found suitable if sufficient carbohydrate was present to prevent inactivation. For the purification of invertase containing small amounts of carbohydrate, slow-freezing was found to be a better method since no inactivation occurred. Purification with the usual adsorbents was not successful in removing more than a fraction of the inactive protein, even after repeated treatments.

The removal of inactive protein was followed by ultraviolet absorption studies, since invertase preparations containing inactive protein showed absorption spectra with maxima at about 280 mμ and minima at about 250 mμ, and also showed shifting of the curves toward higher wavelengths in alkaline solution indicative of the presence of tyrosine, whereas invertase purified by chloroform treatment or by slow-freezing showed no selective absorption in the region 250-280 mμ.

Invertase preparations exhibiting anomalous properties were obtained from bentonite after elution with phosphate or borate buffers. Thus, when preparations so obtained were adsorbed onto calcium phosphate gel, elution could not be effected with the usual buffers, but treatment with acetate of pH 3.7 gave eluates containing less than the usual amounts of inactive protein or carbohydrate. Also, when these preparations were readsorbed onto bentonite, elution could be effected with the usual buffers whereas when the preparations initially eluted with acetate in the usual manner were readsorbed onto bentonite, no elution could be effected with any of the buffers tried.

Invertase was eluted from bentonite only when a relatively large amount of protein was present. In certain cases it was found that invertase was eluted only after it had aged for several days on the bentonite. Invertase could not be eluted from bentonite with ammonium sulfate, but it was readily eluted from calcium phosphate gel with high concentrations of ammonium sulfate.

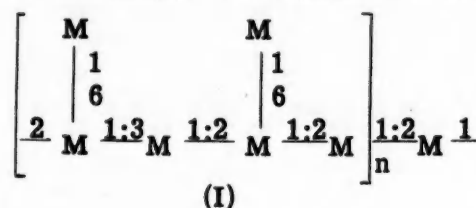
Various results indicate that invertase may be associated with both protein and carbohydrate. Paper partition chromatography showed that invertase traveled diffusely with both the carbohydrate and protein present. Also, invertase purified by slow-freezing was noted to be distributed evenly between the protein-poor frozen and the protein-rich unfrozen fractions.

Carbohydrate appears not to be essential for invertase activity, since most if not all carbohydrate can be eluted from invertase on a carbon-celite column with dilute ethanol. The invertase remaining on the column retains its activity.

Paper chromatography showed the presence of eleven amino acids in purified invertase and glutamic acid was shown by treatment with dinitrofluorobenzene to be a terminal amino acid.

Invertase was not inactivated by treatment with acetic anhydride, indicating that amino groups are probably not essential for enzyme activity.

The carbohydrate present in yeast autolysates and in purified invertase was shown to be yeast mannan. The structure of this polysaccharide was shown by methylation to be very similar to that proposed by Haworth, Heath and Peat (see formula I).



Concanavalin, a globulin obtainable from jack beans, is capable of precipitating yeast mannan quantitatively from an aqueous solution. Use was made of this reaction to develop a method for the determination of micro amounts of yeast mannan. The method was found to be applicable for the quantitative determination of glycogen, also.

New methods using periodate reagents were developed for the identification of amino acids and carbohydrates on paper chromatograms. These methods were useful for the identification of the amino acids and the carbohydrate derivatives obtained from invertase.

Microfilm copy of complete manuscript of 204 pages, \$2.55. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-653.

THE PROPERTIES OF SOME FUNGAL LIPASES AND THEIR ROLE IN GRAIN DETERIORATION

(Publication No. 7222)

Brinton Marlo Dirks, Ph.D.
University of Minnesota, 1953

Investigations of the lipase activity of wheat germ and the molds, *Aspergillus candidus* and a *Penicillium* species, were undertaken to obtain information concerning the relative role of cereal and fungal lipases in the production of fat acidity in stored grain. The studies were carried out in three phases:

1. Three general procedures for assay of lipase activity were investigated. The use of acyl esters of p-nitrophenol were found unsatisfactory for estimating lipase activity colorimetrically. The esters were cleaved non-enzymatically by such reducing agents as glutathione, cysteine, hydroxylamine, and sodium hydrosulfite and by sulfhydryl containing proteins such as bovine serum albumin and heated crystalline egg albumin. Mono-n-butylin was found to be a satisfactory substrate after the commercial product had been purified by a single vacuum distillation. The release of butyric acid from the mono-n-butylin substrate was followed manometrically by measuring the carbon dioxide liberated from a bicarbonate buffer by the acid. The third method involved titration of the butyric acid released from mono-n-butylin after steam distillation of the reaction mixture.

2. Each of the three lipase preparations were investigated in regard to pH optima, temperature optima, the effect of ionic strength, stability to heat, and Km value. None of these properties could be used for distinct differentiation, however, because differences between the two mold lipase preparations were often

greater than between the mold lipases and the wheat germ lipase.

Inhibition by p-chloromercuribenzoate and o-iodosobenzoate provided a method for differentiating the mold lipases from wheat germ lipase. The use of 0.002 M o-iodosobenzoate, for example, inhibited wheat germ lipase 81%, *A. candidus* lipase 14%, and the *Penicillium* lipase 6%. Inhibition by diisopropylfluorophosphate was most effective on the *Penicillium* lipase. Wheat germ lipase and *A. candidus* lipase were inhibited similarly by this compound.

3. Lipolytic activity in moldy wheat was about ten times the activity in a non-moldy control sample of sterile white wheat. In another series of moldy and non-moldy wheats, there was little difference in total lipase activity, but the activity in the moldy samples was inhibited to a lower degree by o-iodosobenzoate than was the activity in non-moldy samples. This indicated that the source of activity in the wheat had changed with the development of molds even though the overall activity remained about the same. Further investigations revealed the presence of a non-dialyzable, heat labile inhibitor for *A. candidus* lipase in extracts of wheat germ which was not precipitable by trichloroacetic acid.

The appearance of fat acidity in stored grain was apparently due chiefly to the activity of fungal lipase although an inhibitor to this activity was present in water extracts of the grain.

Microfilm copy of complete manuscript of 167 pages, \$2.09. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-654.

DIPHOSPHOPYRIDINE NUCLEOTIDE PYROPHOSPHATASE IN VENOM AND MAMMALIAN TISSUES

(Publication No. 7223)

Dean Paul Epperson, Ph.D.
University of Minnesota, 1953

An enzyme present in the venom of most species of venomous snakes and capable of rapidly splitting DPN has been studied using the liberation of CO₂ from a bicarbonate buffer to follow the course of the reaction. With DPN of 90 per cent purity 1 mole of inorganic phosphate and 1.8 moles of CO₂ are released per mole of DPN. As no adenylic acid is found in the reaction product, it is possible that DPN hydrolysis involves the dephosphorylation of the adenine moiety.

When zinc ion is added to the medium the yield of inorganic phosphate is reduced. At 4 millimolar concentration of zinc practically no inorganic phosphate is released, although the final yield of CO₂ is unchanged and 1 mole of adenylic acid is produced per mole of DPN. Neither ammonia nor pyrophosphate is released and the pyridine-ribose bond remains undisturbed. These observations seem to indicate the pyrophosphate bond as the site of the initial breakdown of DPN. The second hydrolysis consists of the

dephosphorylation of adenylic acid by the 5-nucleotidase of venom.

The initial cleavage of reduced DPN is somewhat more rapid and the final phosphate yield greater suggesting partial dephosphorylation of dihydronicotinamide mononucleotide.

The Michaelis-Menten constant was found for the venom enzyme splitting DPN at the pyrophosphate bond, $K_m = 3.36 \times 10^{-4} M$. A high substrate-enzyme affinity was also observed for venom 5-nucleotidase, $K_m = 3.5 \times 10^{-4} M$.

Employing buffers of differing bicarbonate content under varied CO₂ partial pressure a narrow pH optimum was demonstrated between 7.8 and 8.2. The possibility that either enzyme inactivation or that a different ionic form of DPN contributed significantly to the pH activity curve was excluded.

The effect of histamine and a number of other physiologically active compounds on DPN hydrolysis by venom was studied and of the group aminopterin was found to inhibit strongly not only the DPN-pyrophosphatase in venom but the corresponding enzyme in rat kidney as well. A venom antiserum was found to inhibit completely DPN-splitting activity of the same species, but had less effect on the action of venom from more distantly related snake species. There was no inhibitory effect on the DPN-pyrophosphatase of various mammalian tissues.

The distribution and zinc sensitivity of mammalian DPN-pyrophosphatase, its higher activity in cell fragments than aqueous extracts were investigated. Preliminary experiments revealed a low but measurable activity for the enzyme in the leucocytes of normal adults.

The recent findings reported in the literature on the structure of reduced DPN and the nature of the coenzyme-apoenzyme complex are briefly discussed and the available data relating to DPN biosynthesis is summarized. Reviewed in more detail is the role of DPN in the metabolism of tumors.

Microfilm copy of complete manuscript of 86 pages, \$1.08. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-655.

STUDIES ON THE GUMS DERIVED FROM BARLEY FLOUR, WHEAT FLOUR AND FRESH AND STALE BREAD

(Publication No. 7282)

Kenneth Albert Gilles, Ph.D.
University of Minnesota, 1952

The aim of this work was the identification of the water-soluble polysaccharides, exclusive of starch, in barley flour, wheat flour and "fresh" and "stale" white bread.

Procedures were developed for the extraction of the pentosan-rich polysaccharides, hereinafter called gums, which represented approximately 4% of the wheat flour. The gums were precipitated from aqueous solution by the addition of polar solvents, such as

alcohol or acetone, and dried by a solvent exchange procedure. Extraction of wheat flour with a half-saturated ammonium sulfate solution produced a gum which was high in pentosan content (67%) and had $[\alpha]_D -108^\circ$; extraction with cold (3°C. or warm (37°C.) water produced gums containing lesser amounts of pentosans (19.6% and 13.6%) and having $[\alpha]_D +10.6^\circ$ and $+80.4^\circ$, respectively. When these gums were subjected to chromatographic analyses, all contained glucose, arabinose and xylose residues as their component sugars. Fractional precipitation of wheat gum from aqueous solution with alcohol failed to separate the gum into pentosan-rich or hexosan-rich components. Such a separation was effected, however, by fractionating the acetate derivative of the gum from a pyridine solution by the addition of petroleum ether.

Similarly the gums extracted from barley flour and the "soluble starches" extracted from fresh and stale bread were shown to contain glucose, arabinose and xylose. Moreover, when wheat starch was extracted with warm water (70°C.) a pentosan was isolated which represented arabinose and xylose residues.

When the crude barley pentosan was hydrolyzed with N/100 sulfuric acid, chromatographic analysis of the hydrolyzate showed that arabinose residues were preferentially removed. Therefore, it is believed that terminal arabinofuranose residues were subtended from a nucleus of xylopyranose residues.

The paper chromatographic technique was used for the separation of the components of the hydrolyzed gums. After elution of the sugar residues from the paper chromatograms with distilled water, the composition of the hydrolyzate was determined by a new colorimetric procedure which was devised for this purpose. The procedure employed an aqueous phenol solution and sulfuric acid; it was suitable for the micro-determination of sugars, methylated sugars and methyl glycosides in the range of 6 to 60 γ .

A problem created by the presence of extractable contaminants on filter paper was recognized. The effect of this adverse factor was minimized during quantitative chromatographic analyses by developing a "blank" chromatogram in an analogous manner to the test chromatogram.

An investigation of the alkaline ferricyanide procedure for the microdetermination of sugar showed that the method was highly empirical. A change in pH during the oxidation reaction altered the specificity of the reaction.

For comparing the relative extent of oxidation of an untreated polysaccharide and a corresponding polysaccharide which had been reduced with sodium borohydride, the alkaline ferricyanide procedure at ca. pH 10 was used to determine successfully the molecular weights of amylose and laminarin. The method failed when the pH of the oxidation reaction mixture was increased to pH 12.3.

A methylation study of the crude gum isolated from barley flour showed that three polysaccharides were present. One was a β -glucosan similar to cellulose; another was an α -glucosan having a branched structure; another was a β -pentosan containing arabinose and xylose and having a branched structure.

Methylation studies of the pentosan derived from barley flour and from white bread crumb showed that these gums were quite similar. Each methylated gum showed $[\alpha]_D -158^\circ$ ca. and upon hydrolysis each was shown to contain D-xylose, 2-methyl-D-xylose, 2:3-dimethyl-D-xylose and 2:3:5-trimethyl-L-arabinose as structural residues.

Microfilm copy of complete manuscript of 177 pages, \$2.21. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-656.

DISPLACEMENT SEPARATION OF LIPIDS

(Publication No. 7228)

James Guthrie Hamilton, Jr., Ph.D.
University of Minnesota, 1953

The technique of displacement chromatography developed by Tiselius and his co-workers has been applied to the separation of glycerides such as occur in natural fats. Glycerides have heretofore not yielded to any simple means of separation or analysis, but displacement chromatography has proved to be very useful to these ends. The major results are described as follows.

The simple saturated triglycerides from tributyrin to tricaprinn were separated by displacement chromatography on a 14.1 cc. coupled filter column of a 1:2 mixture of Darco G-60 and Hyflo Super Cel as adsorbent. The solvent was absolute ethanol and the displacer was 0.4% trilaurin. Tricaprinn was the most strongly adsorbed, and tributyrin was so weakly adsorbed that it was eluted from the column. A less strongly adsorbed impurity was detected in the sample of tricaprinn. It showed up as an extra elution peak that moved down the column ahead of tributyrin.

Monolaurin, monopalmitin and monostearin were separated on a 14.1 cc. column using the same adsorbent, solvent and displacer as the short chain simple triglycerides. Monolaurin was least strongly adsorbed and monostearin was most strongly adsorbed. Monoolein was less strongly adsorbed than monostearin and separable from it. It had approximately the same adsorbability characteristics as monopalmitin.

To separate the glycerides with a molecular weight greater than trilaurin, benzene was used as the solvent, the adsorbent was a 1:2 mixture of Darco G-60 charcoal and Hyflo Super Cel, and the displacer was 0.5% tristearin. Trilaurin, trimyristin, and tripalmitin were separated on a 44.8 cc. column. Tripalmitin was most strongly adsorbed whereas trilaurin was least strongly adsorbed. In a similar experiment the order of increasing adsorbability was found to be trilaurin, lauryldipalmitin, tripalmitin, and palmitodistearin. Separability was good except for some mixing at the interface between lauryldipalmitin and tripalmitin. A preliminary experiment with beef tallow, although non-ideal, indicated that the method may be of value for the separation of natural mixtures. Triolein had approximately the same adsorbability as

trimyrustin. Trilinolein was less strongly adsorbed than triolein and separable from it.

The order of adsorbability in ethanol was found to be triglyceride > diglyceride > monoglyceride. In benzene the order was monoglyceride > diglyceride > triglyceride. The order of adsorbability within a series was found to be the same for both solvents i.e. monostearin is more strongly adsorbed than monopalmitin in both ethanol and benzene.

Microfilm copy of complete manuscript of 64 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-657.

THE CONSTITUTION OF STARCH

(Publication No. 7284)

John Kelvin Hamilton, Ph.D.
University of Minnesota, 1952

Waxy corn starch, the β limit dextrin obtained by the repeated action of β -amylase on waxy corn starch, and corn amylose were used in this research problem.

In order to facilitate the determination of the length of the repeating unit of the waxy corn starch and β limit dextrin, a periodate oxidation procedure (which in its initial stages avoids over-oxidation) was devised. This was accomplished by allowing the reaction to proceed in the dark at a temperature of 2° to 4° C.

This procedure was followed in the case of waxy corn starch and the β limit dextrin in order to determine the average length of their repeating units. In the case of waxy corn starch, the results showed that the average repeating unit was 18 to 20 anhydroglucose residues. The β limit dextrin was found to have an average repeating unit of 6 anhydroglucose residues.

Following the determination of the repeating unit in the above polysaccharides, the oxidation was allowed to proceed until considerable over-oxidation had taken place and the consumption of periodate was well in excess of the theoretical value required per mole of anhydroglucose unit. This was done in order to ensure complete cleavage of every available α -glycol group in the molecule.

A comparison was made of the rate of consumption of periodate with the production of formic acid during the oxidation of waxy corn starch, β limit dextrin, and corn amylose with sodium periodate, and the structural significance of the results was discussed. It was shown that the terminal non-reducing glucose residues are attacked preferentially.

The polyaldehydes obtained from the prolonged periodate oxidation of waxy corn starch, β limit dextrin, and corn amylose were reduced with sodium borohydride. The reason for the reduction was that, whereas the periodate-oxidized polysaccharides or "polyaldehydes" usually undergo profound decomposition when hydrolysed even in the cold, the corresponding new "polyalcohols" can be subjected to hydrolysis with boiling mineral acid with little or no decomposition, to give cleavage products, which can be sep-

arated by partition chromatography and determined quantitatively. The components of these polyalcohols, following the acid hydrolysis, were identified chromatographically and shown to consist in each case of glycerol, erythritol, glycolic aldehyde, and a small amount of glucose. The presence of glucose indicates anomalous linkages in these compounds.

In the case of the waxy corn starch polyalcohol, the glycerol, erythritol, and glucose obtained by the hydrolysis were positively identified as crystalline derivatives.

The molecular ratio of glycerol to erythritol in the hydrolysed waxy corn starch and β limit dextrin polyalcohols was obtained. The determination of this ratio affords a new method of obtaining the length of the repeating unit. Using this method, waxy corn starch was found to have a repeating unit of 15, whereas that of the β limit dextrin was 4.

In order to ascertain how the unoxidized glucose was linked in the original molecule, the waxy corn starch polyalcohol was methylated. Hydrolysis of the methylated polyalcohol gave a small amount of monomethyl glucose and no dimethyl glucose. Chromatographic evidence indicated that the compound was probably 4-methyl-D-glucose.

The presence of glucose in the hydrolysate of the waxy corn starch polyalcohol and the chromatographic identification of a monomethyl glucose from the hydrolysate of the methylated polyalcohol has provided the first proof of the presence of linkages other than 1, 4 or 1,6 in waxy corn starch. The anomalous glucose residue probably has branches from positions 1,2,3, and 6 and it is present to the extent of approximately 0.5%.

Microfilm copy of complete manuscript of 178 pages, \$2.23. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-658.

THE CHEMISTRY AND ANALYSIS OF HIGHLY UNSATURATED FATTY ACIDS

(Publication No. 7229)

Earl Gullette Hammond, Ph.D.
University of Minnesota, 1953

The highly unsaturated fatty acids of menhaden oil have been partially fractionated and a methyl eicosapentaenoate has been isolated in nearly pure form. This was accomplished by rearrangement of the triglycerides of the fish oil and low temperature precipitation of the more saturated triglycerides in petroleum ether. The low temperature soluble fraction was chromatographed on silica gel and the highly unsaturated fractions obtained were distilled in a spinning band still. The results indicate the presence of a twenty carbon pentaenoate and twenty-two carbon hexaenoate and pentaenoate.

A methyl docosahexaenoate was isolated from hog brain tissue by the following procedure: lyophilized hog brains were extracted with methanolic petroleum ether, and the phospholipids were isolated by

precipitation with acetone. The phospholipids were further fractionated by their solubility in petroleum ether. The petroleum ether soluble phosphoglycerides were subjected to methanolysis and the fatty acid methyl esters were fractionated by low temperature crystallization from acetone. The low temperature soluble fraction was chromatographed repeatedly on silica gel and a methyl docosaheptaenoate was isolated. It was identified by its refractive index, density, molecular refraction, melting point of its hydrogenated product, iodine value, saponification value, ultraviolet spectrum, and infrared spectrum. It was shown to have a normal carbon chain and only *cis* double bonds, none of which were conjugated. Evidence is presented suggesting that its double bonds are located in the 4, 7, 10, 13, 16, and 19 positions.

Conditions and constants for the alkali isomerization spectrophotometric analysis of the docosaheptaenoic fatty acid are given. It was found that the size of the sample and spectrophotometer slit width were especially important in the analysis of this acid by the alkali isomerization method. The effect of heating time and alkali concentration in the analysis procedure were also studied.

A procedure was worked out for the analysis of polyunsaturated fatty acids in human blood plasma. The plasma fatty acids of Guatemalan natives who live on a low fat diet were compared with the plasma of a group on a more typical diet. The Guatemalans were shown to have significantly more trienoic fatty acid. The cause of this was not clear.

Analyses of plasma from patients diagnosed as having atherosclerosis were made and compared to a normal group. Statistically significant differences were found in the amounts of polyunsaturated fatty acids present. This may bear some relationship to the disease.

A relation was worked out for the prediction of the molar volume, density, refractive index, and molar refraction of fatty acids and some of their derivatives from a knowledge of their carbon chain length and the number of their double bonds. It applies only to straight chain fatty acids and derivatives with *cis* unconjugated double bonds. A method for predicting the change in molar volume and density with temperatures was developed.

A relation for predicting the wave length of the absorption peaks of naturally and alkali conjugated fatty acids was developed and this was used to explain some of the properties of the spectra of alkali isomerized fatty acids.

Microfilm copy of complete manuscript of 114 pages, \$1.43. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-659.

QUANTITATIVE HISTOLOGICAL DISTRIBUTION OF β -GLUCURONIDASE IN THE ADRENAL GLAND IN VARIOUS PHYSIOLOGICAL STATES

(Publication No. 7254)

Som Nath Nayyar, Ph.D.
University of Minnesota, 1953

Summary

1. The literature on β -glucuronidase activity in animal and human tissues in various physiological and pathological states has been reviewed.

2. A simple method for the determination of protein-N, involving precipitation of the protein with bromsulphalein and measurement of the excess bromsulphalein in the supernatant, is described. The theoretical limit of determination of protein-N by this method using microscope colorimeter and cuvettes of 10 mm. light path (capacity 7.1 μ l.) is 0.5 μ g. The standard deviation of a single determination using the microscope colorimeter and a sample containing 63.7 μ g. protein-N was 3.4 μ g. or 5.4%. The standard deviation using the Beckman Model DU spectrophotometer with quartz microcuvettes and a sample containing 1.65 μ g. protein-N, was 0.017 μ g. or 1.0%.

3. The distribution of β -glucuronidase in the adrenals of cow, rabbit, rat, guinea pig and rhesus and cynomolgus monkeys is described. Highest β -glucuronidase activity occurs in zona reticularis in the rat, guinea pig and monkey adrenals. In the cow adrenal, the peak value is found in glomerulosa, whereas in the rabbit, the activity is very low in all the zones.

4. Exposure to hyperthermia-hypoxia and the administration of ACTH had no significant effect on the β -glucuronidase distribution — qualitative or quantitative — in the adrenals of rhesus monkeys. Similarly no effect of ACTH, cortisone acetate and desoxycorticosterone was noticed on the distribution of β -glucuronidase in the adrenals of cynomolgus monkeys.

5. β -Glucuronidase activities in fasciculata and reticularis of rhesus monkeys having pulmonary lesions were significantly lower than those of control animals.

6. β -Glucuronidase activities in the sera of cow, rabbit, rat, guinea pig and cynomolgus monkey were found to be 0.1 - 0.4% of the average enzyme activities in the adrenals of these animals.

Microfilm copy of complete manuscript of 89 pages, \$1.11. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-660.

THE CONSTITUTION OF ILES MANNAN:
PART I: THE STRUCTURE OF ILES MANNAN.
PART II: THE COLORIMETRIC DETERMINATION
OF SUGARS

(Publication No. 7291)

Paul Armand Rebers, Ph.D.
University of Minnesota, 1953

The qualitative and quantitative determination of mixtures of monosaccharides produced by hydrolysis of a polysaccharide is of importance in establishing its constitution. The qualitative identification of the sugars present in such a hydrolysate has recently been facilitated by paper chromatography and one of the aims of this investigation was to extend this technique to quantitative analysis. The amounts of sugars which are most conveniently separated by paper chromatography are comparatively small, usually less than one milligram and, therefore, colorimetric techniques seemed most applicable. The most satisfactory method up to the present time for analyzing small amounts of sugars was the anthrone sulfuric acid colorimetric technique. The results of this work show that the anthrone method can be improved by replacing an expensive unstable reagent, anthrone, by a cheap stable reagent, phenol. The intensity of the color produced on the addition of concentrated sulfuric acid to the sugar solution containing phenol is measured in units of optical density by a suitable spectrophotometer. For a given sugar the optical density is proportional to the amount of sugar present.

The analysis is carried out by separation of the sugar mixture using paper chromatography, elution of each sugar from the paper, reaction of the eluate with the phenol sulfuric acid reagent, and determination of the optical density of the solution. The amount of sugar present is then determined by reference to a standard curve which consists of a plot of the optical density versus the amount of sugar.

After the technique of quantitative paper chromatography had been developed and applied to Iles Mannan, methylation studies were carried out. These studies showed that Iles Mannan contained two polysaccharides. The first, comprising about one-sixth of the total polysaccharides, consisted of long, straight chains of glucose residues united by 1-4 alpha glycosidic linkages. The structure is illustrated as

shown $(\frac{G}{4 \ 1})_x$. It showed a high positive rotation, gave a blue color with iodine, and dissolved readily in dilute potassium hydroxide. The structure, composition, and properties of this polysaccharide are similar and almost identical to amylose.

The second polysaccharide, comprising about five-sixths of the total polysaccharides, consisted of long, straight chains of glucose and mannose residues united by 1-4 beta glycosidic linkages. One possible arrangement is illustrated thus $\frac{G \ M \ M}{4 \ 1 \ 4 \ 1 \ 4 \ 1}$. It had a negative rotation, gave no color with iodine and was insoluble in dilute potassium hydroxide. It could be dissolved in alkali after treatment with a strong aqueous solution of sodium xylenesulfonate.

Separation of the methylated polysaccharides was effected by a "crystallization" technique. The mixture was dissolved in acetone at room temperature and then cooled to 0° F. and allowed to stand overnight. The negatively rotating glucomannan precipitated out in a much greater amount. Complete separation was effected by repeating the process several times.

The linkages present in each polysaccharide were established by the preparation of the cleavage products of the methylated material. The presence of 2,3,6-trimethyl-D-glucose in the methylated glucan was established by the preparation of the crystalline di-p-nitrobenzoate derivative.

In the case of the glucomanna, the 2,3,6-trimethyl-D-glucose was separated from the 2,3,6-trimethyl-D-mannose by a novel technique, selective furanoside formation. After separation had been effected, the presence of each sugar was confirmed by the preparation of the crystalline di-p-nitrobenzoate derivatives.

Microfilm copy of complete manuscript of 147 pages, \$1.84. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-661.

THE MECHANISMS OF ENZYMIC REACTIONS
OF PHOSPHATE AS STUDIED
WITH SODIUM AZIDE,
2, 4-DINITROPHENOL AND COMPOUNDS
OF TRIVALENT PHOSPHORUS

(Publication No. 7262)

Hugh Elburn Robertson, Ph.D.
University of Minnesota, 1953

This thesis represents an attempt to elucidate some facets of the mechanism of enzymic reactions of phosphate by study of the manner in which such reactions are inhibited or influenced by chemical agents. In addition to studies with such proven inhibitors as sodium azide and DNP, studies were included on the behaviour in enzymic reactions of phosphate of the stereochemically related phosphites.

The established capacity of azide and DNP to interfere with anaerobic phosphate esterification by intact cells did not extend to phosphatase-deficient cell-free extracts of yeast fermenting glucose, even when concentrations of azide as high as 0.025 M or DNP 0.001 M were used. The high concentrations employed reduced the possibility that these agents were inactive because they had been removed from solution by adsorption on the contained soluble proteins. It is concluded that the action of these agents on fermenting intact cells must be at a site other than in the glycolytic sequence of reactions.

The possibility that azide in intact cells acted on the phosphatases that were missing in cell-free preparations was reduced by the finding that 0.05 M or 0.01 M azide had no effect on the activity of intestinal phosphatase. Other workers had shown these agents did not accelerate the more specific phosphatases such as purified ATP-ase.

It is suggested that the action of azide and DNP in disturbing phosphate esterification in fermenting intact cells, develops at the same site as their action on respiring cells. It is postulated that these agents act by catalyzing the decomposition of some phosphorylated intermediate in the electron transport system that is in equilibrium with the adenylic system.

Glucose-6-phosphite was synthesized and its behaviour studied in enzymic reactions of glucose-6-phosphate. The phosphite ester was found to be neither substrate nor inhibitor for the action of purified yeast hexokinase, glucose-6-phosphatase, glucose-6-phosphate dehydrogenase, glycolytic enzymes of intact yeast, or cell-free extracts. Monohydrogen phosphite esters of ethyl, isopropyl, and butyl alcohol were prepared and found to act neither as substrates nor inhibitors for intestinal phosphatase.

Inorganic ortho phosphite was neither able to relieve the phosphate requirement for fermentation by cell-free extracts or for the action of 3-phosphoglyceraldehyde dehydrogenase, nor was it able to inhibit these reactions. 0.05 M phosphite had no effect on the fermentative capacity of the intact yeast.

Some studies on the toxicity to rats of phosphite and phosphite esters are reported. The compounds tested proved to have little toxicity for the rat.

Observations are recorded on the stability of ortho phosphite solutions, their resistance to oxidation by molecular oxygen, and their potential usefulness as buffers in biological studies in the pH range of 5.5 to 7.5.

A hypothesis has been advanced to explain the observed difference in behaviour of phosphites and phosphates in enzymic reactions of phosphate. It is proposed that many enzymic reactions of phosphate proceed by an enzyme-catalyzed nucleophilic attack by the oxygen atom of the acceptor on the phosphorus atom of the phosphate group of the donor. The greater ionic character of P-O bonds of phosphate as compared to the negligible ionic character of the P-H bond of phosphite would result in a more electropositive character for the phosphorus in phosphate than in phosphite, and hence a greater vulnerability of phosphate phosphorus to nucleophilic attack. This hypothesis also serves to explain the mechanism of enzymic transfers of esterified phosphate.

Microfilm copy of complete manuscript of 166 pages, \$2.08. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-662.

CHEMISTRY, INORGANIC

METAL COMPLEXES WITH OPTICALLY ACTIVE DIAMINES

(Publication No. 7267)

Richard Charles Toole, Ph.D.
University of Minnesota, 1953

The optical activity of 1-propylenediamine has been measured as a function of its concentration in aqueous solutions. Measurements of the density and rotatory dispersion of such solutions have shown that the optically active species is the same at every concentration, and that the variation of rotatory power cannot be attributed to the formation of definite hydrates.

The change in rotatory power of 1-propylenediamine when the amine groups are neutralized with acid has been studied. Rotations are reported for the mono- and di- acid salts with both HCl and HNO₃. The rotation of dilute 1-propylenediamine solutions increases with the formation of the mono-acid salts. Neutralization of the second amine group results in a decrease, and a change in sign, of the optical rotation. The dissociation constants of the acid salts were determined.

The rotatory power of complexes of 1-propylenediamine with Zn²⁺, Cd²⁺, Hg²⁺, and Ag⁺ has been measured as a function of the number of propylenediamine molecules in the complex. With Zn²⁺ and Cd²⁺ complexes, the rotation of complex bound 1-propylenediamine molecule reaches a minimum with the formation of a bis complex. An interpretation is offered for the rotatory power of 1-propylenediamine complexes with Zn²⁺, Cd²⁺, Hg²⁺, and Ag⁺, based on the assumption of an equilibrium between monodentate and bidentate forms of the complex.

The optical activity of 1-propylenediamine was found to be unaffected by the presence of salts of barium and magnesium. This would indicate that even very weak diamine complexes of these metals do not exist in solution.

Rotatory dispersion measurements have been made with 1-propylenediamine, its acid salts, and its complexes with Zn²⁺, Cd²⁺, Ag⁺, Pt²⁺, and Pt⁴⁺. The dispersion data for a large number of metal - diamine complexes, reported previously in the literature, have been interpreted in the light of these results.

For all colorless complexes containing optically active diamines, the rotatory dispersion can be expressed by a one term Drude equation. The dispersion was found to be independent of the nature of the metal ion or the optically active diamine. When such complexes contain two or more optically active diamine ligands, the source of optical activity appears to be an amine absorption band at approximately 2370 Å. When the complex contains less than two active ligands the activity can be attributed to an optically active absorption at about 2750 Å.

In complexes where the metal atom acts as a center of asymmetry, due to a special geometric arrangement of optically inactive diamine ligands, the dispersion is quite different. Where such complexes contain an optically active diamine, any contribution

of the asymmetric metal atom to the dispersive power is masked by the contribution of the active ligand.

The rotatory dispersion of 1-propylenediamine has been interpreted on the basis of a one term Drude equation. Such an interpretation allows a correlation of the rotatory dispersion of a number of optically active diamines. In each case, the optical activity is attributed to an active absorption band at 1380 Å.

Microfilm copy of complete manuscript of 94 pages, \$1.18. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-663.

CHEMISTRY, ORGANIC

THE SYNTHESIS OF MONO AND DIBENZOFUORENE DERIVATIVES FOR ANTI-CANCER INVESTIGATIONS

(Publication No. 7039)

Prince Gordon Harrill, Ph.D.
Northwestern University, 1953

This investigation was undertaken in order to develop a new general method for the synthesis of substituted polycyclic fluorenes, in particular, 13-H-dibenzo [a, g] fluorene (I). Recent studies (1, 2) have shown that this hydrocarbon exerts a statistically significant delaying action on methylcholanthrene skin carcinogenesis in mice.

The present synthesis utilizes the known ring closure of benzoic acid to yield 9-fluorene-9-carboxylic acid (3). In an analogous reaction, 1,2'-naphthilic acid gave rise to the expected 13-H-dibenzo [a, g] fluorene-13-carboxylic acid when heated with aluminum chloride in benzene. This acid was readily decarboxylated by heating with barium hydroxide octahydrate in ethylene glycol yielding I. The previously unknown, 1,2'-naphthilic acid was prepared in the following manner. The reaction of 2-naphthylacetyl chloride with di-(1-naphthyl) cadmium yielded 1,2'-deoxynaphthoin which was oxidized with selenium dioxide to 1,2'-naphthil. The rearrangement of this diketone was studied using both aqueous and non-aqueous conditions.

This reaction sequence, via the appropriate deoxybenzoins, benzils and benzoic acids, was also used to prepare six benzofluorenes: 11-H-benzo [a] fluorene, 7-H-benzo [c] fluorene, 8-methyl-7-H-benzo [c] fluorene, 10-methyl-7-H-benzo [c] fluorene, 8-methyl-11-H-benzo [a] fluorene and 10-methyl-11-H-benzo [a] fluorene. These hydrocarbons are currently being evaluated as potential carcinogenic antagonists. The latter two hydrocarbons, as well as a number of the intermediate compounds prepared, have not been previously described.

A synthesis is proposed for the preparation of alkyl substituted 11-H-naphtho [2,1-a] fluorenes. In this manner, it was hoped that the structure of "Diel's Second Hydrocarbon" might be elucidated. This compound was obtained from a selenium dehydrogenation of cholesterol using the conditions described by

Ruzicka (4). The hydrocarbon thus isolated melted at 225-226°.

The proposed synthesis is based on the known condensation of 2-morpholinomethyl-1-hydrindone methiodide with ethyl sodioacetoacetate yielding 3-keto-2-carbethoxy-10,1,2,3-tetrahydrofluorene (5). Thus, the possibility exists that o-carbomethoxybenzyl methyl ketone could be made to participate favorably as a phenyllog of ethyl acetoacetate in this condensation. By using the Mannich base from an appropriately substituted 1-hydrindone, the resulting intermediate could provide a route to the desired naphthofluorene nucleus.

Attempts to improve the yield in the condensation of the Mannich base with ethyl sodioacetoacetate were unsuccessful using either sodium ethoxide or trityl sodium as base. During this study, the preparation of o-carbomethoxybenzyl methyl ketone by two possible methods was investigated.

REFERENCES

1. A. Lacassagne, Buu-Hoi and G. Rudali, Brit. J. Exper. Path., **26**, 5 (1945).
2. B. Riegel, W. B. Wartman, W. T. Hill, B. B. Reeb, P. Shubik and D. W. Stanger, Cancer Research, **11**, 301 (1951).
3. R. T. Arnold, W. E. Parham and R. M. Dodson, J. Am. Chem. Soc., **71**, 2439 (1949).
4. L. Ruzicka, M. W. Goldberg and G. Thomann, Helv. chim. Acta, **16**, 812 (1933).
5. R. H. Harradence and F. Lions, J. Proc. Roy. Soc. N. S. Wales, **72**, 284 (1939).

Microfilm copy of complete manuscript of 79 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-664.

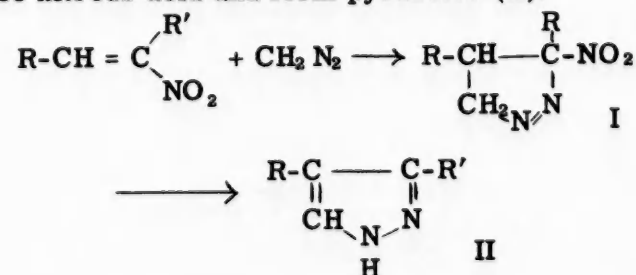
PART I: REACTIONS OF NITROOLEFINS WITH DIAZOCOMPOUNDS PART II: REACTIONS OF BENZO-1,4-DITHIADIENE

(Publication No. 7285)

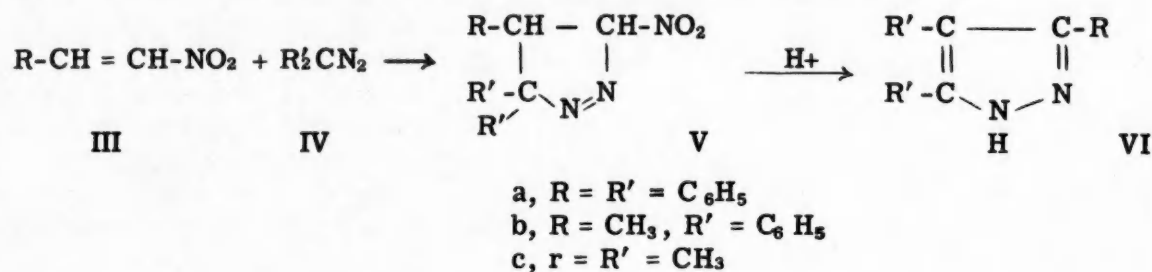
William Robert Hasek, Ph.D.
University of Minnesota, 1953

PART I

Parham and Bleasdale recently demonstrated that nitroolefins react with diazomethane to give nitropyrazolines (I) which, when treated with acids, lose nitrous acid and form pyrazoles (II).



This knowledge, together with our present knowledge of rearrangement reactions, suggested that acid-catalyzed decomposition of pyrazolines V would also give pyrazoles, but with migration of substituents.



The purpose of this investigation was to study the reactions of nitroolefins (III) with disubstituted diazomethanes (IV), and the course of the acid-catalyzed decomposition of the resulting pyrazolines (V).

Although diphenyldiazomethane (IVa) failed to react with 1-nitro-2-phenylpropene-1, it reacted with β -nitrostyrene (IIIa) to give a pyrazoline formulated as Va. Acid-catalyzed decomposition of Va gave, in high yield, 3,4,5-triphenylpyrazole (VIa), whose structure was proved by a new independent synthesis. The acid-catalyzed conversion of Va to VIa appears to occur by a twofold Wagner-Meerwein rearrangement.

Diphenyldiazomethane reacted with 1-nitropropene-1 (IIIb) to give the pyrazoline Vb. Acid-catalyzed decomposition of Vb gave, in high yield, 3-methyl-4,5-diphenylpyrazole (VIb), whose structure was proved by oxidation to the known 4,5-diphenylpyrazole-3-carboxylic acid.

In order to test the generality of the method, some reactions employing dimethyldiazomethane (IVc) were studied. Reaction of IVc with 1-nitropropene-1 gave a pyrazoline which was not obtained pure, but which gave 3,4,5-trimethylpyrazole (VIc) on treatment with acid. Reaction of IVc with β -nitrostyrene gave two crystalline compounds whose compositions approximated that of the expected nitropyrazoline, but their exact nature was not determined; an attempt to obtain a pyrazole by treatment of one of them with acid failed.

It was found that diphenyldiazomethane decomposes in hydrocarbon solvents with the formation of sym-tetraphenylethane and a yellow 1:1 molar complex of sym-tetraphenylethane with benzophenone azine.

PART II

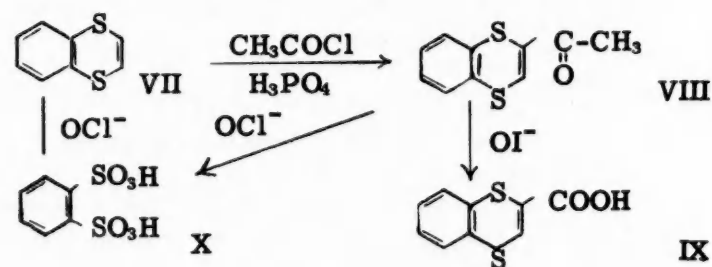
Parham, Roder, and Hasek recently reported the synthesis and proof of structure of benzo-1,4-dithiadene (VII). These workers reported the nitration and formylation of VII, and concluded that this ring system possesses aromatic character. The purpose of this investigation was to study the Friedel-Crafts acylation and mercuration of VII in order to extend our knowledge of substitution in this system, and to furnish desirable intermediates for synthesis of proposed pharmaceuticals.

Reaction of VII with acetyl chloride and orthophosphoric acid gave 2-acetylbenzo-1,4-dithiadene (VIII) in 30% yield. Attempts to acylate VII with benzoyl chloride and orthophosphoric acid resulted

principally in the recovery of starting material. Boron trifluoride, stannic chloride, and aluminum chloride were ineffective as catalysts for the Friedel-Crafts acylation of VII.

The structure of VIII was established by oxidation with hypiodite to the known benzo-1,4-dithiadene-2-carboxylic acid (IX). Oxidation of either VII or VIII with hypochlorite gave high yields of benzene-o-disulfonic acid (X).

The action of mercuric chloride on benzo-1,4-dithiadene gave a product formulated as 2-chloro-mercuribenzo-1,4-dithiadene. Although this product reacted with steam and hydrochloric acid to give benzo-1,4-dithiadene, it failed to give ketonic products by reaction with acetyl chloride. Attempts to form mono- and diacetoxymercury derivatives were not successful. It was concluded that mercuration, as applied to VII, would have little synthetic value.



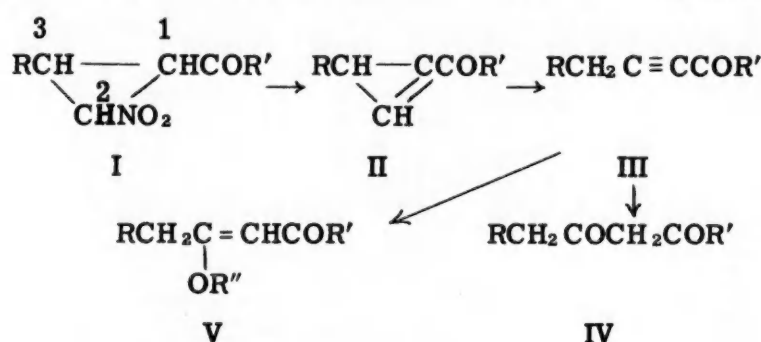
Microfilm copy of complete manuscript of 147 pages, \$1.84. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-665.

CYCLOPROPANES IX: A REVIEW OF THE WORK OF KOHLER AND WILLIAMS; AN ATTEMPT TO PREPARE AN ALLENIC KETONE

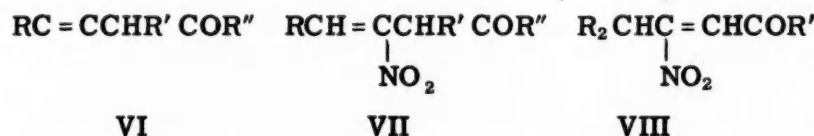
(Publication No. 7234)

Earl Douglas Holly, Ph.D.
University of Minnesota, 1953

Kohler and Smith (1) were the first to suggest a mechanism for the action of bases upon secondary nitrocyclopropyl ketones I, whereby the cyclopropane ring was opened with production ultimately of a 1,3-diketone IV. The suggested steps were: (a) removal of the elements of nitrous acid from I, with formation of the cyclopropene II; (b) rearrangement of II to the alpha, - beta-acetylenic ketone III; (c) addition of the elements of water (or of an alcohol) to III with production of IV (or its enol ether V).

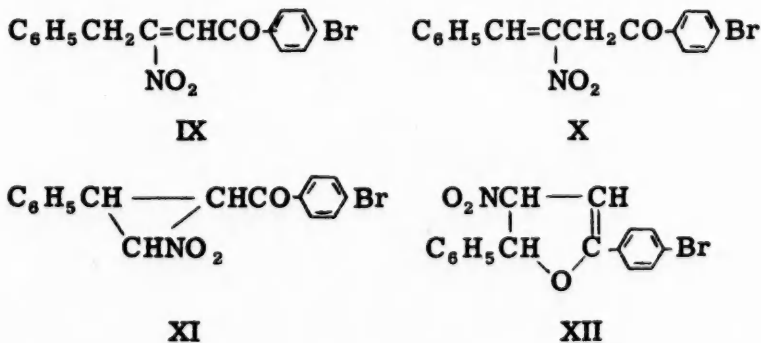


Smith and Engelhardt (2) pointed out that, if there were no hydrogen atom attached to C-1, the acetylenic ketone would be, of necessity, a beta, gamma-acetylenic ketone VI. In order to fit this intermediate into the scheme of Kohler and Smith, it would be necessary to postulate a preferential mode of addition of alcohol to VI, and there was no reason to expect this. A different mechanism was suggested by Smith and Engelhardt (3) involving one or the other of the unsaturated nitroketones VII and VIII as intermediate.



Smith and Kelly (4) showed that a compound of type VII was not an intermediate. Kohler and Williams (5) had reported the synthesis of the only known compound of type VIII.

It was proposed to synthesize IX and X from XI by the method of Kohler and Williams, and to study these compounds as possible intermediates in the action of bases upon XI. Errors were found in the work of Kohler and Williams, and it was not possible to prepare compound IX (type VIII) as reported by them. A repetition of their work, step by step, was carried out in order to determine whether or not Kohler and Williams had actually had substance IX in hand, but had

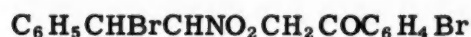


assigned to it an incorrect structure.

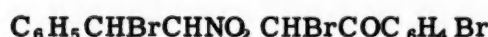
The two stereoisomers of XIII were formed by action of hydrogen bromide upon the stereoisomers of XI. One of these was converted by action of potassium acetate into XII. XII was identified by its melting point and its facile loss of nitrous acid as the substance assigned structure X by Kohler and Williams. XII was converted by heating into the furan XIV.

The second stereoisomer of XIII was converted by action of potassium acetate into X. Ozonolysis of X to form 4-bromoacetophenone established the structure of X. X was formed also by action of potassium

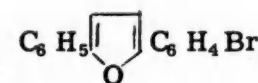
iodide upon the bromine adduct XV. X was identified by its melting point and its yellow color as the substance obtained from XV by Kohler and Williams and assigned by them structure IX. No substance having structure IX could be isolated.



XIII



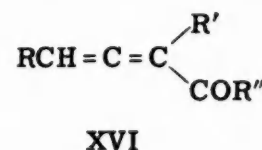
XV



XIV

In connection with this work, experimental facts were accumulated which made possible a partial assignment of absolute configurations to the three stereoisomers of XI which were obtained. These facts were: (a) the relative stabilities of the stereoisomers as shown by the interconversions which were observed; (b) the relative reactivities of the carbonyl groups with 2,4-dinitrophenylhydrazine; (c) the stereochemistry of the addition of hydrogen bromide and of hydrogen chloride to the stereoisomers; and (d) the dipole moments of the stereoisomers.

Allenic ketones XVI were an additional class of compounds which might be intermediates in the reaction of I with bases. Such ketones were unknown. Experiments designed for the synthesis of either XVI or VI were performed so that these compounds might be studied as intermediates. No successful synthesis of either type of ketone was achieved.



BIBLIOGRAPHY

1. E. P. Kohler and L. I. Smith, J. Am. Chem. Soc., **44**, 624 (1922).
2. L. I. Smith and V. A. Engelhardt, J. Am. Chem. Soc., **71**, 2671 (1949).
3. L. I. Smith and V. A. Engelhardt, J. Am. Chem. Soc., **71**, 2676 (1949).
4. L. I. Smith and R. E. Kelly, J. Am. Chem. Soc., **74**, 3300 (1952).
5. E. P. Kohler and H. E. Williams, J. Am. Chem. Soc., **41**, 1644 (1919).

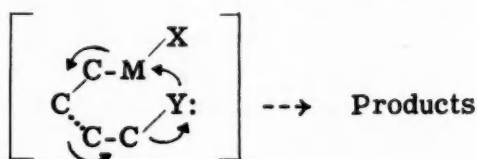
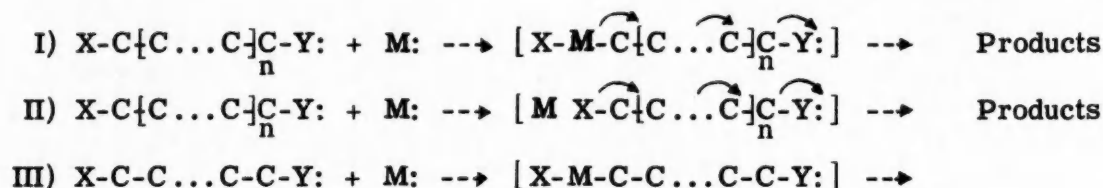
Microfilm copy of complete manuscript of 152 pages, \$1.90. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-666.

THE REACTION OF METALS
WITH 1,4-DIHALIDES AND
SOME SIMILAR COMPOUNDS

(Publication No. 7193)

Thomas Herbert Liddicoet, Ph.D.
University of Washington, 1953

Lanka in 1951 investigated the elimination reaction of metals such as zinc, magnesium, or iodide ion with 1,4-dihalides and several analogous compounds. Three possible mechanisms were originally advanced to account for the course of these reactions (Equations I, II, and III).



Where: M is a metal such as zinc or magnesium,
or possibly iodide ion
X is a halogen atom
Y is an electronegative element or group
C...C is a double or triple bond

As a result of his work the assumption that these reactions might proceed by mechanism III does not appear tenable.

It was the original purpose of this research to study additional examples of this type of reaction in order to further test the applicability and to obtain additional evidence regarding the mechanism. A further purpose was to investigate the properties and reactions of simple, unsubstituted cumulenes containing an even number of carbon atoms.

Several compounds of the general type which might be expected to undergo the elimination reaction were synthesized and found to react with metals in the predicted way.

The reaction of 1,4-dibromo-2-butyne with zinc in diethylene glycol diethyl ether, dioxane, or acetonitrile yielded butatriene. The structure of this compound was proved by bromination to the known 1,2,3,4-tetrabromo-2-butene, carbon/hydrogen analysis, molecular weight determination, mass spectrum, infrared spectrum, and ultraviolet spectrum.

Attempted investigation of the reactions of butatriene usually led to indeterminate results. However hydration of butatriene with concentrated sulfuric acid gave methyl vinyl ketone. Also excess bromine gave 1,2,3,4-tetrabromo-2-butene, and excess iodine gave a tetraiodide. However attempted addition of hydrogen, diazoacetic ester, maleic anhydride, cyclopentadiene, and phenyl azide gave no identifiable product and usually a polymeric residue.

Butatriene was also prepared by the interaction of 1-bromo-4-phenoxy-2-butyne or 1,2,3,4-tetrabromo-2-butene with zinc in diethylene glycol diethyl ether.

Attempted extension of the general reaction to compounds in which neither of the electronegative groups was a halogen atom was not successful. The action of zinc or magnesium on 1,4-dimethoxy-2-butene gave no butadiene. Therefore it seems that at least one halogen is necessary for this reaction to proceed.

The reaction of γ -bromocrotonyl chloride with zinc in benzonitrile gave vinylketene, a previously unknown compound. This new compound was characterized by reaction with aniline or water to give the expected anilide or acid, carbon-hydrogen analysis of a dimer or polymer, ultraviolet and visible spectrum, mass spectrum, and infrared spectrum. This

is the first reported example of an α, β -unsaturated ketene.

Reaction of γ -bromo- α -phenylcrotonyl chloride with zinc gave evidence indicating that perhaps phenylvinylketene was formed, but the compound could not be isolated.

Attempted extension of the reaction to compounds containing the unsaturation in an aromatic system was unsuccessful. Treatment of *p*-xylylene dibromide with zinc or magnesium gave a polymer but no *p*-quinodimethane.

The action of zinc and magnesium on 1,6-dibromo-2,4-hexadiyne in benzonitrile gave a polymer having the correct carbon/hydrogen ratio for a polymer of the supposed monomer, hexapentaene. However the monomer could not be isolated.

The fact that both butatriene and vinylketene could be prepared in a nitrile solvent provides negative evidence against mechanism I being applicable in this type of reaction. Intermediate formation of an organo-metallic compound would have been expected to be followed by its reaction with the nitrile solvent.

Microfilm copy of complete manuscript of 121 pages, \$1.51. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-667.

THE PREPARATION OF SOME ALKENYLBORINES

(Publication No. 7197)

Theran Duane Parsons, Ph.D.
University of Washington, 1953

Dimethylvinylborine, divinylmethylborine and trivinylborine were prepared by the reaction of dimethylboron bromide with vinyl sodium. Dimethylpropenylborine and dipropenylmethylborine were prepared by an analogous reaction between dimethylboron bromide and propenyl lithium and by treatment of propenyl lithium with trimethylborine followed by decomposition of the quaternary salt with water. Unavoidable side reactions, particularly polymerization, caused low yields. These compounds were characterized by elemental and structural analyses.

The mixed alkenylmethylborines disproportionate into symmetrical products, slowly at room temperature and at an accelerated rate during reactions involving formation and decomposition of ammoniates. However, their stabilities are magnitudes greater than those of the corresponding saturated derivatives. A mechanism is proposed for the disproportionation of unsymmetrical borines in general, accounting for these differences in stability, involving transitory formation of a bridged structure.

Methods are proposed for studying the interaction of the pi electrons of the alkenyl group with the vacant orbital of the boron atom.

Microfilm copy of complete manuscript of 53 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-668.

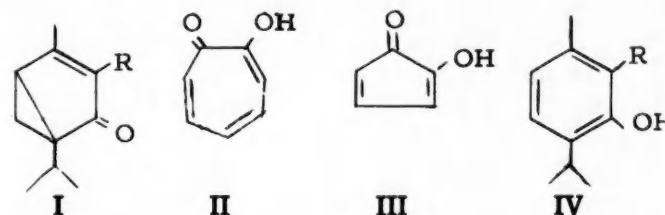
CONTRIBUTIONS TO THE CHEMISTRY OF UMBELLULONE

(Publication No. 7508)

James Carroll Selover, Ph.D.
Stanford University, 1954

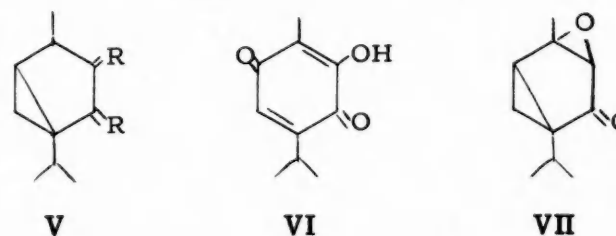
Umbellulone (I, R=H) is a bicyclic monoterpene ketone isolated from the oil of the California laurel (*Umbellularia californica* N.). The presence of a three-membered ring in umbellulone and some of its derivatives imparts to these compounds a special interest which led to an investigation dealing with reactions of umbellulone and its congeners to evaluate the ability of the cyclopropane ring to act as a source of unsaturation electrons. Accordingly, it was the primary purpose of the investigation to prepare α -hydroxyumbellulone (I; R=OH) and to determine whether or not this compound behaved as an analog of the tropolone (II) or the 2-hydroxycyclopentadienone (III) systems. Attempts to convert α -bromoumbellulone (I; R=Br) to α -hydroxyumbellulone led to the formation of a new compound, 2-piperidinethymol (IV; R=NC₅H₁₀). It was found possible to prepare isonitroso- β -dihydroumbellulone (V; R=O, R'=NOH) in small yield, but hydrolysis to the α -diketone failed.

The reaction which produced the isonitroso compound also produced a neutral oil, which on hydrolysis with



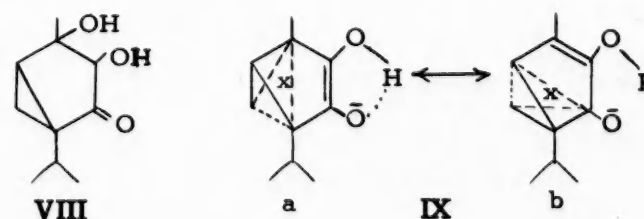
alkali gave a crystalline substance, C₁₀H₁₈NO₃, tentatively designated as 3,5,6-trimethyl-4-oximinoheptanoic acid. The selenium dioxide oxidation of β -dihydroumbellulone (V; R=O, R'=H₂) and thujone (V; R=H₂, R'=O) both yielded 3-hydroxythymoquinone (VI) rather than α -hydroxyumbellulone. The abnormal course of these reactions indicates the ease with which a cyclopropane ring interacts with contiguous functional groups.

The reaction of umbellulone with alkaline hydrogen peroxide gave rise to epoxyumbellulone (VII). This material was isomerized to 6-methyl-3-isopropylcatechol (IV; R=OH) by heating and gave α -ethoxyumbellulone (I; R=OC₂H₅) on treatment with alcoholic



potassium hydroxide. Hydrolysis of epoxyumbellulone produced 1,2-dihydroxydihydroumbellulone (VIII) which on treatment with alkali was converted to α -hydroxyumbellulone.

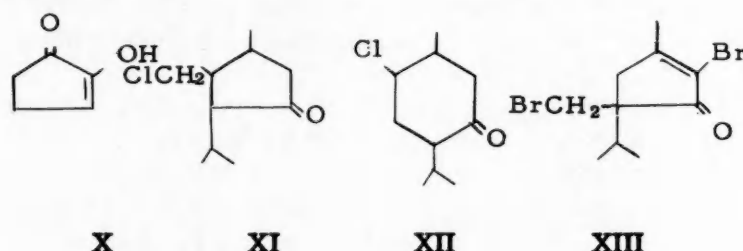
α -Hydroxyumbellulone is a weak acid of pK ca. 9 as compared to tropolone with a pK of 7. The infrared spectrum indicates that α -hydroxyumbellulone is strongly hydrogen bonded (OH stretching at 2.98 μ) but not nearly as much as is tropolone (OH stretching at 3.22 μ). The polar non-classical resonance contributions (IX -a and IX -b) may account for the strong hydrogen bonding of α -hydroxyumbellulone.



There is also the possibility that the three-membered ring of α -hydroxyumbellulone by making the system more rigid confers on it the properties of 2-hydroxy-2-cyclopentene-1-one (X). The formation of a dioxime (V; R,R'=NOH) of α -hydroxyumbellulone supports this latter view. A differentiation between the two possibilities describing the ground state of α -hydroxyumbellulone awaits further investigation. It may be stated, however, that in the photoexcited state the

three-membered ring of α -hydroxyumbellulone, as well as the three-membered ring of other compounds containing the umbellulone ring system, exerts a conjugation effect with the α, β -unsaturated carbonyl function. Such interaction has been represented by a resonance hybrid which includes the polar non-classical forms IX -1 and IX -b.

It has also been shown that the hydrochlorination of β -dihydroumbellulone leads to a mixture of chlorocyclopentanones (XI) and chlorocyclohexanones (XII) from which β -dihydroumbellulone is regenerated in excellent yield on treatment with alkali. A mechanism has been proposed which indicates a stereospecific chemical course for this reaction. A mechanism has also been presented to explain the formation of dibromodihydroumbellulone (XIII) in the bromination of umbellulone.



Microfilm copy of complete manuscript of 110 pages, \$1.38. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-669.

SYNTHESES AND REACTIONS OF SULFONIC ANHYDRIDES

(Publication No. 7175)

Paul Herman Settlage, Ph.D.
Vanderbilt University, 1953

Supervisor: Professor Lamar Field

The synthesis and reactions of anhydrides of sulfonic acids have not been extensively studied, although this class of compounds has been known for many years. In order to make this class of compounds more readily available, two convenient and economical laboratory syntheses of alkanesulfonic anhydrides were developed.

The first procedure consists of reaction of the sulfonyl chloride with mercuric oxide in *sym*-tetrachloroethane, removal of the inorganic residue, and distillation or recrystallization of the anhydride after removal of the solvent. Methanesulfonic anhydride was obtained in 67% yield, and ethanesulfonic anhydride in 75% yield. A representative aromatic sulfonic anhydride, *p*-toluenesulfonic anhydride, was also prepared in 69% yield. This method thus appears to be general for aromatic anhydrides and primary alkane-sulfonic anhydrides.

The second procedure consists of reaction of the sulfonic acid and phosphorus pentoxide. The phosphorus pentoxide is mixed with an inert support consisting of kieselguhr and asbestos fiber to facilitate subsequent extraction of the anhydride with ethylene

chloride. After removal of the solvent, methanesulfonic and ethanesulfonic anhydrides were obtained in 58 and 62% yields, respectively.

The value of the molal freezing point depression constant of methanesulfonic anhydride was found to be approximately 14. Samples of methanesulfonic and *p*-toluenesulfonic anhydrides were found to contain less than two per cent of impurity, even when their melting ranges were quite broad and their melting points were three to twelve degrees lower than those of the very pure anhydrides.

A number of reactions of methanesulfonic anhydride were investigated. In two of these, the Friedel-Crafts reaction with benzene in which methyl phenyl sulfone is formed, and the reaction with silver cyanate in which methanesulfonyl isocyanate is formed, the anhydride showed potentially useful differences from methanesulfonyl chloride.

Methanesulfonic anhydride forms a solid and rather stable 1:1 complex with pyridine in quantitative yield. The complex is rapidly decomposed in aqueous solution, so that formation of complexes of this kind followed by decomposition with sodium bicarbonate solution was found to be a convenient method for removing sulfonic anhydrides from reaction mixtures.

Methanesulfonic anhydride reacts with diethyl ethoxymagnesiummalonate, and also with diethyl sodiomalonate to form diethyl methylsulfonylmalonate. The yields are somewhat lower (56 and 25%, respectively) than those obtainable in the reaction between methanesulfonyl chloride and diethyl sodiomalonate (59%).

Both β -naphthyl acetate and ethylene dibenzoate were obtained by the esterification of the appropriate hydroxyl compound with the carboxylic acid in the presence of methanesulfonic anhydride. The yields were the same as those which can be obtained by the use of trifluoroacetic anhydride under slightly milder conditions. Attempts to form sucrose octaacetate were unsuccessful, although this compound has been obtained in 67% yield by the use of trifluoroacetic anhydride.

Two other seemingly attractive reactions were investigated with unpromising results. Methanesulfonic anhydride did not yield an α -amino sulfone derivative with *N*-acetylphenylalanine, although acetic anhydride is known to yield an α -amino ketone derivative. *p*-Toluenesulfonic anhydride did not yield di-*p*-tolyl disulfone with salts of *p*-toluenesulfinic acid under a variety of conditions.

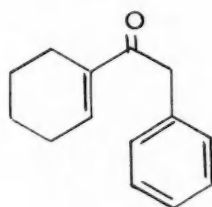
Microfilm copy of complete manuscript of 88 pages, \$1.10. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-670.

STUDIES IN A SYNTHESIS OF
DEHYDROABIETIC ACID

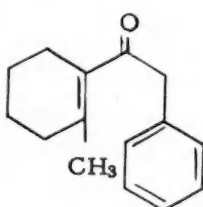
(Publication No. 7273)

Edward Lockwood Wheeler, Ph.D.
University of Minnesota, 1953

In connection with synthesis of octahydrophenanthrenes related to dehydroabietic acid, cyclohexanone and 2-methylcyclohexanone were condensed with phenylacetylene using potassium *t*-butoxide for the catalyst, and the respective acetylenic alcohols obtained were converted via a Rupe rearrangement to the α , β unsaturated ketones (I and II). Cyclization of I (1), using aluminum chloride and hydrogen chloride

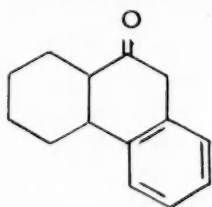


I.

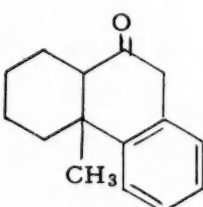


II.

as the catalyst, in refluxing benzene, gave the octahydrophenanthrene (III) in low yield as a mixture of isomers; whereas, cyclization of II gave the octahydrophenanthrene (IV) in 72% yield. Only one isomer appeared to be present.

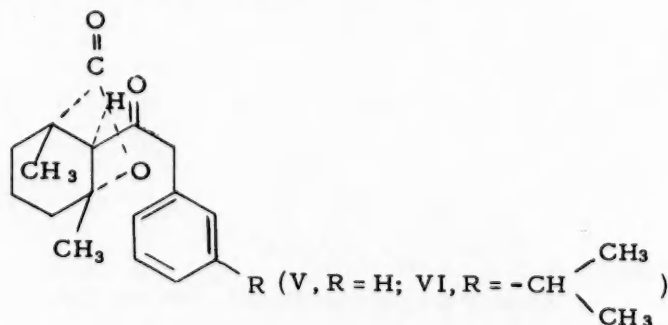


III.

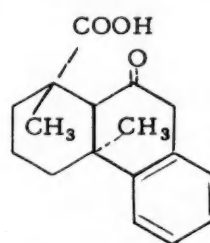


IV.

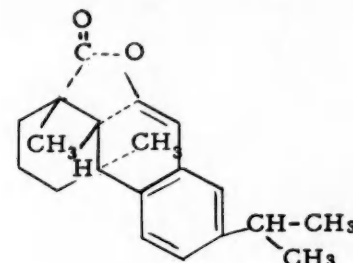
When 2,6-dimethyl-2-carbethoxycyclohexanone was condensed via a Grignard reaction with phenylacetylene and 3-isopropylphenylacetylene, respectively, the acetylenic alcohols were obtained in 55% yield. Treatment of these acetylenic alcohols with formic acid under conditions of the Rupe rearrangement did not give the α , β unsaturated ketones, but instead gave keto-lactones (V and VI). The rearrangement to produce the keto-lactones was shown to be a complex reaction, but one major reaction path was involved. The normal α , β unsaturated ketone was formed, followed by hydrolysis of the ester group and lactonization of the resulting acid across the conjugated double bond to produce V and VI.



Cyclization of either of these ketolactones produced the keto-acid (VII). Thus, the isopropyl group in VI was cleaved by the action of aluminum chloride. Cyclization using polyphosphoric acid retained the isopropyl group, but gave an enol-lactone (VIII). A

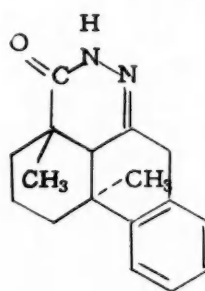


VII.

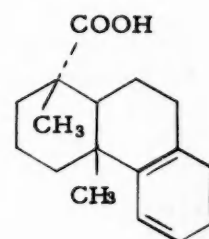


VIII.

Wolff-Kishner reduction of the keto-acid (VII) yielded one neutral product (IX) and two isomeric 1,12-dimethyl-1-carboxy-1,2,3,4,9,10,11,12 octahydrophenanthrenes (X). The neutral product was shown to be a heterocyclic compound formed by the intramolecular cyclization of the intermediate hydrazone with the carboxyl group.



IX.



X.

The action of aluminum chloride on dehydroabietic acid was shown to result in the cleavage of the isopropyl group to produce a 1,12-dimethyl-1-carboxy-1,2,3,4,9,10,11,12-octahydrophenanthrene isomeric with the other two acids. If no isomerization occurred during this reaction, then it is proposed that this acid had a configuration identical to dehydroabietic acid, while the two isomers obtained from the Wolff-Kishner reduction had configurations which differed at the C_{11} and C_{12} positions.

Infrared and ultraviolet spectra were obtained on almost all of the compounds prepared. Ultraviolet spectra was also used to follow the course of the Rupe rearrangement, and in the chromatographic separation of the products from this rearrangement.

REFERENCES

- (1) C. D. Gutsche and W. S. Johnson, *J. Am. Chem. Soc.*, **68**, 2239 (1946).

Microfilm copy of complete manuscript of 130 pages, \$1.63. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-671.

CHEMISTRY, PHARMACEUTICAL

THE REFORMATSKY REACTION IN
THE SYNTHESIS OF COMPOUNDS
HAVING POTENTIAL AMEBACIDAL ACTIVITY

(Publication No. 7424)

Andrew Lasslo, Ph.D.

University of Illinois

Chicago Professional Colleges, 1952

Introduction

In the course of an investigation of a synthesis of amebacidal agents structurally related to emetine, we became interested in the behavior of s-dichloroacetone in Reformatsky condensation reactions.

A large number of communications dealing with this reaction have accumulated in the literature since the originator published his first report (1). The progress and scope of this synthetic approach was thoroughly reviewed by Shriner (2) and later developments reported by Miller and Nord (3) and Treibs and Leichsenser (4).

Although the use of the original Reformatsky reaction was extended in many directions, the literature did not reveal information on the use of this reaction in the condensation of halogenated aliphatic ketones with α - and β -bromoesters, except for Shriner's note: "The reaction follows an abnormal course with halogenated aliphatic ketones..." (2).

In the process of our investigation we employed many of the solvents cited in the literature and the various forms of zinc metal recommended as condensing agents in the communications on the Reformatsky reaction. The suggestion of publications which recommended the use of magnesium was followed, the copper-cup method examined, and various catalysts given consideration.

Experimental

Ethyl β -Hydroxy- γ,γ' -dichloroisovalerate (I).

The all glass apparatus used in the following syntheses was oven dried before use.

Freshly distilled s-dichloroacetone (0.3 mole) was placed into a 500 ml. round bottom flask, attached to a condenser bearing a calcium chloride drying tube and allowed to cool. To this was added 0.3 mole of freshly sandpapered zinc foil*, followed by 200 ml. of sodium-dried dioxane and 0.3 mole of freshly distilled ethyl bromoacetate. The contents of the reaction flask were thoroughly mixed, a few crystals of iodine added, and allowed to stand for 15-20 minutes at room temperature.

Reaction was initiated by cautiously heating with flame until the first signs of reaction appeared. The heating was discontinued and the continuing reaction controlled, as necessary, by cooling in ice water. No additional heating was necessary and the reaction stopped after about 45 minutes. Toward the end of this period the flask was occasionally shaken and the mixture was allowed to cool to room temperature.

Summary

The behavior of s-dichloroacetone in Reformatsky reactions with α - and β -bromoesters was investigated.

Suitable reaction conditions were developed for the condensation of the aliphatic halogenated ketone with α -bromoesters and a possible theoretical explanation of the experimental results was presented. It was established that under identical conditions the interaction with a β -bromoester will not yield the expected reaction product.

The normal Reformatsky condensation products were characterized and their structure proved.

The compounds derived from these esters were tested for amebacidal activity and relative acute toxicity. Apparent relationships between the chemical constitution and the amebacidal action of these moieties were discussed.

*We found that other forms of zinc caused considerable difficulty. The findings of Natelson and Gottfried (7) seem to agree with our observations. The zinc metal foil, which we used, had a thickness of 0.06mm. It was thoroughly sandpapered with No.1 sand paper, immediately before the reaction. Through the sandpapered sheets, pin points of light were observable when held against a light source. These were cut into squares not exceeding 1 cm².

The zinc metal foil was furnished to us through the courtesy of J. T. Baker Chemical Company, Phillipsburg, N. J.

Microfilm copy of complete manuscript of 75 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-672.

A STUDY OF FACTORS INFLUENCING
THE RELEASE OF CERTAIN ANTI-
INFECTIVE AGENTS FROM
EMULSION TYPE DERMATOLOGIC VEHICLES

(Publication No. 7206)

Krishna Chandra Varma, Ph.D.

University of Washington, 1953

Dermatologists are giving increased thought to the wisdom of incorporating the anti-infective agents they want to use in emulsion type vehicles. These make pharmaceutically attractive preparations and under many circumstances appear to offer superior therapeutic performance. However, a review of the literature reveals a lack of conclusive information concerning the effects of such factors as the nature of emulsifying agents and their concentration, nature of the oil phase, oil-water ratio, and viscosity on the release of the anti-infective from the emulsion type vehicle.

In order to collect such data medicated and unmedicated emulsions were prepared in which the effects of variation in several physical and chemical factors could be studied. Basically the procedure involved the measurement of bacteriostatic activity of the emulsions using agar cup-plate technic. The anti-infectives used were penicillin, aureomycin, Chloromycetin, bacitracin, streptomycin, Actamer and Hexachlorophene. These were incorporated separately in

emulsions prepared with 15 different emulsifying agents. The influence of the emulsifying agents on the bacteriostatic activity of the anti-infectives was measured. Several series of emulsions were prepared using different concentrations of Span 40, Arlacel 60, Tween 80, and glyceryl monostearate S.E. as emulsifiers in order to determine the influence of variation in the concentration of emulsifying agents. In similar fashion the influence of other factors on the bacteriostatic activity of anti-infectives incorporated in emulsions prepared with non-ionic emulsifiers was studied by agar cup-plate method. These factors were the nature of the oil phase, oil-water ratio, concentration of the anti-infectives, pH variation under experimental conditions, viscosity and stability of anti-infectives in various emulsion type vehicles.

The following conclusions were drawn from the results of the study. The choice of emulsifying agent is important for a given anti-infective. Non-ionic agents are to be preferred for a simple emulsion type dermatologic vehicle, since they form good emulsions and do not possess any activity of their own. An increase in the concentration of nonionic emulsifying agents used does not increase the bacteriostatic activity of the anti-infectives.

An increase in the concentration of the oil in emulsions prepared with nonionic emulsifiers usually decreases the bacteriostatic activity. This decrease in activity may be due to the sudden increase in viscosity when oil concentration is raised.

The antibiotics used generally exhibit better activity in simple emulsions prepared with nonionic emulsifiers than in those containing waxes and fatty substances. On the contrary, Actamer and Hexachlorophene show better activity in emulsions containing waxes and fatty substances.

Generally, the antibiotics show good stability in Span 40 and Arlacel 60 emulsions. However, penicillin loses its bacteriostatic activity in Span 40 and aureomycin in Arlacel 60 emulsion. Chloromycetin, streptomycin, Actamer and Hexachlorophene are generally stable in all the emulsions which show any activity.

Microfilm copy of complete manuscript of 118 pages, \$1.48. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-673.

CHEMISTRY, PHYSICAL

ON THE ROLE OF LATERAL INTERACTION IN PHYSICAL ADSORPTION

(Publication No. 7188)

William MacLeod Champion, Ph.D.
University of Washington, 1953

One of the most serious defects in the B.E.T. theory of multilayer adsorption is the neglect of

horizontal interactions between adsorbed molecules. Hill¹ derived a set of equations which remedied this defect. However, it developed that most of the adsorption above the first layer took place at a relative pressure near unity. If the model is extended to include a London-type dispersion force decaying from the surface, it has been shown that adsorption will proceed in a step-wise fashion. Efforts to calculate a smooth isotherm on a uniform surface resulted in the introduction of unreal assumptions with regard to the manner in which the adsorption energy decays from the surface. Halsey² has shown that the introduction of heterogeneous energy sites and cooperative adsorption allows the calculation of smooth isotherms which show the general characteristics of experimental isotherms. This simple model however, does not take into account entropy variations over the surface.

Hill's equations which include lateral interaction were further modified to bring in the concepts of a decaying adsorption energy, and adsorption sites of heterogeneous energy distribution.

Isotherms were calculated which agreed in their qualitative properties with a wide variety of experimental isotherms. In addition to the isotherms, entropies and heats of adsorption were calculated. These calculated thermodynamic functions demonstrated the characteristic maxima and minima of the experimental curves.

1. T. L. Hill, *J. Chem. Phys.* **15**, 767 (1947)
2. G. D. Halsey, *J. Am. Chem. Soc.*, **73**, 2693 (1951).

Microfilm copy of complete manuscript of 75 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-674.

AN X-RAY SPECTROMETER STUDY OF ELEMADIENOLIC ACID

(Publication No. 7221)

Richard Milton Curtis, Ph.D.
University of Minnesota, 1953

A method for adaptation of the General Electric XRD-3 Spectrometer to single crystal studies has been developed. Intensities are measured with a Geiger-Muller tube and scaling circuit utilizing the stationary-crystal technique. In this arrangement the crystal is held stationary during the scaling of each reflection and a measure of the integrated intensity is obtained by using an x-ray beam with angular divergence greater than the mosaic spread in the crystal. Strong reflections are reduced in intensity by a filter with multiple layers of foil.

In addition to the usual corrections for background, Lorentz, and polarization factors, the procedure requires a correction for the gradual separation of the $K\alpha$ doublet components in the incident radiation with increasing reflection angle. The correction is obtained from measurements of $K\beta$ reflections. Deviations from the known ratio of the

K_{β} to K_{α} intensities arise from the inability to observe both K_{α} components in the reflections at higher Bragg angles and these deviations are used to provide a suitable correction curve.

The stationary-crystal method requires an x-ray beam of uniform intensity throughout the angular divergence range. In the event a source does not meet this requirement, it is possible to obtain an approximate set of integrated intensities by comparison of the observed data with a set of intensities obtained from photographs. More exact corrections to give integrated intensities are obtained during refinement of the structure by comparison of observed and calculated structure factors. Accurate results can be obtained in this way since the correction for a nonuniform x-ray beam depends only on the angle the crystal makes with the beam direction and not upon the Bragg angle.

Intensity measurements, following the above procedure, have been made on elemadienolic acid, $C_{30}H_{48}O_3$. This is a triterpene crystallizing in the orthorhombic system with four molecules per unit cell. The space group is $D_2^4 - P2_12_12_1$ with unit cell dimensions $a = 39.14$, $b = 10.00$, $c = 7.09\text{\AA}$. Approximately 92 percent of the hko and hol reflections available to Cu K_{α} radiation were observed. The structure has not been determined.

Microfilm copy of complete manuscript of 102 pages, \$1.28. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-675.

THE KINETICS OF THE SULFITE-THIOSULFATE EXCHANGE REACTION

(Publication No. 7491)

Mother Charlotte Anne Dames, Ph.D.
Stanford University, 1954

In the presence of electrolytes there exist very definite effects on the velocities of reactions occurring in solution between ions. These have been interpreted in terms of the Brønsted-Debye relationship:

$$\log k' = \log k'_0 + z_A z_B \sqrt{\mu}$$

but anomalous results have been found for a number of reactions and various explanations have been proposed to preserve the validity of the Brønsted-Debye relationship. Recently several workers have claimed that the dependence of the rate on the ionic strength of the solution is not the true relationship involved. Instead they propose that specific reaction rates show a functional dependence on the concentration of some specific ion and not upon the ionic strength.

One of the most recently investigated ionic reactions is that of the exchange reaction between sulfite and thiosulfate ions which can be followed by means of radioactive sulfur. This reaction was treated as a simple bimolecular reaction. Unequivocal results were not obtained with the method used

which involved establishing a definite ionic strength by the addition of excess inert salt. The object of the work of this dissertation was to repeat the above work without adding inert salts in order to follow the effect of changing the ionic strength as well as to see if there is any dependence on some specific ion.

The exchange reaction was followed by determining the radioactivity of the originally inactive thiosulfate solution which was precipitated as triethylenediamine nickel thiosulfate for counting. The reaction was carried out with solutions of concentrations ranging from 0.003M to 0.10M for sodium sulfite and 0.02M to 0.10M for sodium thiosulfate solutions. The temperature range was 29.85°C. to 64.55°C. In this range of concentration and temperature specific reaction rate constants were determined by three methods:

1. The rate of the reaction was determined graphically according to the relationship worked out by Duffield and Calvin based on the fact that no matter what the actual kinetics of the exchange reaction, the rate of appearance of radioactivity in the compound which was originally inactive will be first order with respect to the activity:

$$R = -2.303 ab/(a+b) \cdot d/dt \log(1-x)/x_{\infty}$$

The specific reaction rate, k , was then determined assuming a simple bimolecular reaction:

$$R = k(SO_3^{--})(S_2O_3^{--})$$

The constants thus determined do not follow the Brønsted-Debye relationship. Instead of decreasing with decreasing ionic strength, they increase.

2. The experimental data were next used to calculate the rate constants from the kinetic law for a simple bimolecular reaction:

$$k = 1/t(a+b) \ln b/a \cdot (a-x)/(b-x)$$

These "constants" increase with increasing time which is indicative that the order of reaction is lower than that of the kinetic law being applied.

3. Since an exchange reaction of the type being studied is a reversible reaction and the rate constant for the forward reaction must be equal to that of the reverse reaction, any assumption that the reversible character of the reaction may be ignored was considered invalid and the following relationship was derived:

$$k = 2.303/t(a+b) \log ab/[ab - (a+b)x]$$

Applying this law to the experimental data, constants are obtained which do not show anomalous effects with respect to ionic strength and in fact are independent of the ionic strength as would be expected in the concentration range used. In addition, comparisons of the results in solutions made with distilled water with those made with buffer

solution, which involve inert salts, seem to indicate that there is a dependence on the presence of some specific ion in the solutions, the constants being higher in the latter case.

Microfilm copy of complete manuscript of 101 pages, \$1.26. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-676.

SOLID STATE REACTIONS: INVESTIGATION OF COLOR AND COMPOUND FORMATION IN THE SYSTEMS ZrO_2 - SiO_2 - V_2O_5 AND Cr_2O_3 - Al_2O_3 - ZnO ; DIFFUSION OF CHROMIUM OXIDE THROUGH ALUMINA

(Publication No. 7210)

Charles Holmes Herty III, Ph.D.
Lehigh University, 1954

The purpose of this research was to study the reactions occurring between finely divided solids at high temperatures, but well below the melting point of the solids. This involved investigation of color development and compound formation in ceramic oxides. The effects of particle size, temperature, time, and composition were noted in two ternary systems, the ZrO_2 - SiO_2 - V_2O_5 system, and the Cr_2O_3 - Al_2O_3 - ZnO system. The diffusion of Cr_2O_3 into Al_2O_3 at five different temperatures, ranging from 1260° to 1595°C, using aluminas of varying bulk densities, was studied as a separate problem.

In the ternary systems, the powdered mixtures were heated either in the form of compressed pellets or as loose powders. Color identification was visual while compound identification was made by X-rays.

In the diffusion study, pellets of Cr_2O_3 were placed upon alumina which had been packed into an alundum thimble. Firing of the samples lasted 8 hours at the desired temperature. The amount of Cr_2O_3 which had diffused through the alumina was determined by analyzing successive layers of powder colorimetrically, using a spectrophotometer. Conclusions gained from the experiments were as follows:

I. ZrO_2 - SiO_2 - V_2O_5 system: (1) Blue color in this system is probably caused by the presence of tetravalent vanadium, possibly as the dioxide, in the ZrSiO_4 structure. (2) The reduction of the V_2O_5 is aided by the presence of a halide reducer, but the resulting compound may discolor the desired blue product. Iodides and bromides darken the product, chlorides and fluorides merely hasten the reduction. (3) An excess of V_2O_5 is necessary in order to insure getting the proper amount of vanadium into the lattice structure. (4) ZrO_2 and SiO_2 react initially to form ZrSiO_4 at about 700°C, 1000° below the decomposition temperature.

II. Cr_2O_3 - Al_2O_3 - ZnO system: (1) Colored triangular diagrams of three-component systems can be useful for determining compound formation in general phase diagrams, and can be of practical

value to ceramic pigment manufacturers. The compound ZnCr_2O_4 was identified in this manner. (2) Solid solutions of Cr_2O_3 in ZnAl_2O_4 give pink color to the system. The color is produced more quickly when the Cr_2O_3 is added to the ZnAl_2O_4 directly instead of firing the three initial components. (3) Chrome-pinks are produced when Cr_2O_3 penetrates a crystal lattice. Initial penetration is caused by a large concentration gradient at the surface of the crystal. Within the crystal color production is rapid, whereas from crystal to crystal color development is slow. (4) When Cr_2O_3 is added to powdered Al_2O_3 mixtures of varying grain size, the intensity of the color produced upon heating is greater the smaller the grain size. This is due to the fact that a thin film of color is produced around each particle and will only show up in the bulk form when many particles are present.

III. Diffusion of Cr_2O_3 into Al_2O_3 : (1) At temperatures ranging from 1260° to 1595°C, measurable diffusion is caused by gaseous Cr_2O_3 molecules moving through the pores of the alumina powder. (2) The maximum limit of ruby color development is determined by a critical concentration gradient below which no crystals will be colored. (3) The method used in this experiment gave qualitative results. In order to obtain data suitable for mathematical treatment, a more refined method should be used. If one wishes to investigate the solid phase aspect of Cr_2O_3 diffusion, higher temperatures and longer heating times are required. In addition, more data are necessary on the relationship between solid Cr_2O_3 and its vapor.

Microfilm copy of complete manuscript of 73 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-677.

THE CRYSTAL AND MOLECULAR STRUCTURE OF B_5H_{11}

(Publication No. 7243)

Louis Richard Lavine, Ph.D.
University of Minnesota, 1953

Analysis by three-dimensional Fourier and least-squares methods of 298 X-ray diffraction maxima from single crystals of B_5H_{11} has yielded its molecular structure. There are four molecules in a monoclinic unit cell having parameters $a = 6.76$, $b = 8.51$, $c = 10.14\text{\AA}$ and $\beta = 94.3^\circ$. The space group, $P2_1/n$ is unique. Boron positions were located unambiguously from analysis of the three-dimensional Patterson function. The hydrogen atoms appeared as the eleven highest peaks in the asymmetric unit, containing one molecule, in a three-dimensional Fourier series from which the contributions of boron atoms were subtracted. Although no molecular symmetry is required the molecular dimensions indicate C_s symmetry. Within the limits of error all B-H (nearly single bond) distances are equal, and all B-H (bridge) bonds are equal. One unusual hydrogen

atom is singly bonded to a central boron but can also be said to form very weak bonds, bond order of about $1/6$, to two neighboring boron atoms. Molecular parameters, and their average deviation from the mean when more than one is averaged, are two B-B = 1.86 ± 0.005 Å, two B-B = 1.75 ± 0.02 Å, two B-B = 1.72 ± 0.02 Å, one B-B = 1.77 Å, seven B-H ("single" bond) = 1.07 ± 0.04 Å, six B-H (bridge) = 1.24 ± 0.07 Å, one B-H ("double bridge") = 1.00 Å, and two B-H ("double bridge") = 1.67 ± 0.09 Å. While these average deviations may be comparable with probable errors, it is possible that the incompleteness of the Fourier series may give rise to some systematic shortening of the B-H distances. This shortening is slightly greater than that for B_4H_{10} where the Fourier series was more nearly complete. However, the molecular geometry seems to be established.

That the boron atoms are a fragment from the icosahedron seems to have been generally expected from the principles previously realized from studies of $B_{10}H_{14}$ and B_5H_9 . Although one cannot predict the hydrogen positions with confidence, an arrangement close to that found can be obtained either by taking apart the $B_{10}H_{14}$ structure or by adding onto the B_4H_{10} structure. Both of the highly reactive B_5H_{11} and B_4H_{10} molecules have relatively open structures as compared with the compact arrangements in $B_{10}H_{14}$ and B_5H_9 . The geometrical properties of these fragments of the icosahedron or octahedron, the occurrence of bridge hydrogens at open edges, and the liganacy of five or six for boron are principles now common to all of the boron hydrides whose structures are established. The unusual hydrogen atom in B_5H_{11} may, however, be an intermediate type, between a normal "singly bonded" hydrogen and a bridge hydrogen, perhaps not too dissimilar to the unsymmetrical hydrogen bridges previously established in $B_{10}H_{14}$ and in B_4H_{10} .

In addition to material directly related to the main problem the appendices contain wiring diagrams and directions for performing many of the standard calculations necessary for crystal analysis by the use of X-ray diffraction with the aid of an IBM 602-A Calculating Punch and auxiliary machines.

Microfilm copy of complete manuscript of 110 pages, \$1.38. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-678.

CHROMATOGRAPHIC BEHAVIOR, SOLUBILITIES, AND PARTITION RATIOS OF ERGOSTEROL AND CALCIFEROL IN SOLVENT MIXTURES

(Publication No. 7478)

Frederick J. Miller, Jr., Ph.D.
Michigan State College, 1952

The chromatographic behavior of hexane-dioxane mixtures on Superfiltrol is discussed and the adsorp-

tion of dioxane from hexane solutions on Superfiltrol, calculated from chromatographic studies, is verified by data obtained by the normal method for determining adsorption from solution.

Chromatographic behavior of ergosterol and calciferol on Superfiltrol with eluting solvent mixtures of dioxane and hexane is discussed and an equation is deduced which relates the adsorbate retained by the chromatographic column to the quantity of the adsorbent, to the amount of adsorbate entered on the column, and to the volume of solution containing the adsorbate before adsorption. The chromatographic separation of calciferol from ergosterol is discussed and an 81% recovery of pure calciferol from a 50-50 mixture of calciferol and ergosterol is demonstrated utilizing superfiltrol as the adsorbent and a 1.96% dioxane in hexane eluting solvent mixture.

Solubilities are given for ergosterol and calciferol in ethanol-water mixtures and for ergosterol in hexane-ethanol mixtures and in hexane-dioxane mixtures. The solubility of non-electrolytes in binary solvent mixtures is discussed and the solubility of ergosterol and calciferol in ethanol-water mixtures is shown to be explainable by an equation derived from regular solution theory.

Partition ratios are listed for ergosterol and calciferol in the two phase, liquid-liquid system, hexane-methanol-water. The change in the partition ratios with the amount of water in the system, is discussed as is the possibility of separating ergosterol and calciferol by counter-current extraction procedures utilizing a liquid-liquid system consisting of hexane and 95% methanol.

Microfilm copy of complete manuscript of 68 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-679.

THE STABILITY OF ION EXCHANGE RESINS TO X-RAYS

(Publication No. 7176)

Robert E. Wedemeyer, Ph.D.
Vanderbilt University, 1953

Supervisor: Dr. M. D. Peterson

Four different types of synthetic ion exchange resins were tested for radiation stability. The radiation used was an x-ray beam produced by equipment especially designed to operate at high intensity for long periods of time. The equipment produced an estimated dose rate of 2×10^6 roentgens per minute at the tube window. Half-thicknesses of the resin samples for this low energy radiation were about 1.3 mm.

Samples of several brands of each of four types of ion exchange resin were irradiated for various time intervals. The approximate average degradation, as measured by exchange capacity loss, was determined for each type after 20 hours of irradiation (about 10^9 roentgens).

Strong-acid (Sulfonic) type	- 10%
Weak-acid (Carboxylic) type	- 100%
Strong-base (Quaternary amine) type	- 40%
Weak-base (Primary amine) type	- 20%

In general, the relative radiation stabilities of the resins correspond to previously reported stabilities of low-molecular-weight compounds with the same active groups.

Considerable variation in radiation stability was found to exist between brands of each type, but this variation can be explained on the basis of the amount of cross-linkage in the resin copolymer - the greater the cross-linking, the more stable the resin to radiation. With the strong-acid-type resin, both weight loss and capacity loss decrease with increasing cross-linkage up to about 8%, but little change in either loss occurs with cross-linkage above about 8%.

Radiation stability was also found to be somewhat dependent upon the exchangeable ion present on the resin, the heavier the ion (more electrons), the greater the degradation.

The effect of heat on the resin capacity, the effect of particle size of the resin on stability, and the solubility of the resins in the solutions used were all found to be negligible.

A semi-quantitative investigation was made of the degradation products of the most widely used resin type, the strong-acid type with sulfonic acid reactive groups. No detectable weakly acidic fragments or neutral organic fragments were produced. The capacity loss could be approximately accounted for by the amount of sulfur released from the resin, about two-thirds of this sulfur being present as free SO_4^{2-} or water-soluble sulfonic acid fragments, and one-third being present as higher molecular-weight, water insoluble, sulfonic acid fragments.

Analytical methods for determining the capacities of ion exchange resins are presented in detail.

Microfilm copy of complete manuscript of 86 pages, \$1.08. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-680.

PART I. THE REDUCTION OF HEXAVALENT CHROMIUM AT A NICKEL ANODE-NICKEL SULFATE SOLUTION INTERFACE DURING ELECTROLYSIS. PART II. THE EFFECTS OF CHROMIUM IN NICKEL SULFATE SOLUTIONS ON THE PHYSICAL PROPERTIES OF ELECTRODEPOSITED NICKEL

(Publication No. 7480)

John Kenneth Werner, Ph.D.
Michigan State College, 1953

Part I

An investigation of the reduction of hexavalent chromium at a nickel anode-nickel sulfate solution interface during electrolysis was made to determine the site of the reduction and some of the factors influencing this reaction. The reduction of chromium

(VI) by nickel metal was studied with and without electrolysis. Without an externally applied electromotive force, the nickel metal was immersed in a buffered nickel sulfate solution containing a known amount of chromium (VI). For the experiments in which an external electromotive force was used, the anolyte containing varying amounts of chromium (VI) was separated from the catholyte by a porous porcelain membrane.

The results of these studies indicated that the reduction of chromium (VI) was due to the presence of the nickel metal whether or not it was anodically polarized and that the rate of the reduction reaction was a function of surface area and pH. Within limits, the current density had little effect when electrolytic nickel was used as the anode. When the anodic current density was increased sufficiently, the reduction rate increased sharply due to the formation at the surface of the anode of an intermediate partially-oxidized product which was readily susceptible to further oxidation by any chromium (VI) present.

Part II

Using highly purified buffered nickel sulfate solutions of four different types, the effect of the presence of chromium (III) and chromium (VI) in solution on the physical properties of electrodeposited nickel was studied. The physical properties used for a basis of comparison were: appearance, adhesion, ductility, salt-spray (fog) corrosion resistance, and throwing power and efficiency.

This investigation showed that the permissible concentration limits for chromium (VI) were lower than chromium (III) though both had similar effects. When both forms were present the adverse effects were greater than for either alone.

No effect on adhesion was noted within the concentration limits chosen and the effect on appearance and throwing power and efficiency was slight. In the case of resistance corrosion by salt spray (fog), the presence of chromium (VI) in low concentration seemed to have the opposite effect of the presence of small amounts of chromium (III). The greatest influence of the chromium in both valence states was observed in the property of ductility in which a decided decrease proportional to chromium concentration was observed.

Microfilm copy of complete manuscript of 69 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-681.

AN INVESTIGATION OF THE CEROUS-SULFATE COMPLEX IONS BY THE SPECTROPHOTOMETRIC METHOD

(Publication No. 7179)

Raymond George Wymer, Ph.D.
Vanderbilt University, 1953

Supervisor: Dr. Merlin D. Peterson

A spectrophotometric study has been made of the aqueous cerous-sulfate complex ions at cerium and acid concentrations higher than any investigated heretofore. Evidence was found for only one complex ion, namely, CeSO_4^{+1} . Dissociation constants have been calculated for this complex ion under several different conditions of acidity and ionic strength. These constants are summarized in Table I.

TABLE I
DISSOCIATION CONSTANTS AND EXTINCTION COEFFICIENTS OF CeSO_4^{+1} AT 25°C.
(Cerium concentration approx. 0.01 M)

Ionic Strength (LiClO_4)	Acidity (HClO_4)	Extinction Coefficient, E		Dissociation Constant
		269 m μ	296 m μ	
0.76	0.11 N	210	50	0.070
0.76	0.50 N	210	50	0.076
1.76	0.11 N	240(?)	56	0.11
1.76	0.50 N	240	56	0.11

In the course of the above study it was necessary to determine the bisulfate ion dissociation constants over the range of acidity and of ionic strength covered by Table I. These constants, calculated from measurements of the solubility of radioactive silver sulfate in lithium perchlorate-perchloric acid solutions, are shown in Table II.

TABLE II
BISULFATE ION DISSOCIATION
CONSTANTS AT 25°C.

Ionic Strength (LiClO_4)	HSO_4^{-1} Dissociation Constant
0.50	0.13
1.00	0.14
2.00	0.145

In connection with this work an accurate method for measuring the exchange capacity and exchange constant of any strong-acid-type cation exchange resin in the presence of concentrated salt solutions (up to about 2 M) was developed. The method involves equilibration of resin in the hydrogen form with a concentrated salt solution, and titration of the acid released from the resin. A linear plot of simple functions of acid released and volume of salt solution used gives the resin capacity from the intercept and the exchange constant from the slope.

Microfilm copy of complete manuscript of 95 pages, \$1.19. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-682.

ECONOMICS

ECONOMICS, GENERAL

MANAGEMENT TRAINING FILMS: THEIR DESIGN, PRODUCTION, AND APPLICATION

(Publication No. 5469)

Claude Swanson George, Jr., Ph.D. and
Robert James Parden, Ph.D.
State University of Iowa, 1953

Supervisors: Prof. J. Wayne Deegan
Prof. Karl E. Leib

This dissertation is a study of the design and production of sound motion pictures and their application. Much of the material is applicable to both institutional and industrial training.

The use of films in training requires a brief look at the learning process and an evaluation of the effectiveness of motion pictures in aiding the learning process. These areas are discussed in Chapter II.

Having established that films are an effective teaching aid, Chapter III is devoted to a consideration of some of the variables of material presentation which should be considered in designing a training film. This includes such items as the use of the audio and the visual media, the level of verbalization in narration, the use of color versus black and white film, the desirability of a musical background, and similar variables in presentation.

The actual production of the film is considered in Chapter IV, principally from the standpoint of the person planning or designing a film as reflected in the preparation of a script. The mechanics of the actual production are mentioned briefly.

A good training film is of little value if it is used improperly. The methods by which films can be used most effectively to aid in learning are reviewed in Chapter V.

In conjunction with a review of the research on effective film design, two sound industrial training films were produced: "Process Charts - How They

Are Made and Used" and "Man-Machine Charts - How They Are Made and Used."* The scripts for these films are included in Appendix A.

Suggestions for using the films are shown in Appendix B.

For more effective presentation of the subject material, training manuals for use with the films are included in Appendix C. These manuals include a review of the film material, plus augmenting information and problems.

* Available from: Bureau of Audio-Visual Instruction, State University of Iowa, Iowa City, Iowa.

Microfilm copy of complete manuscript of 223 pages, \$2.79. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-820.

AN ECONOMIC ANALYSIS OF THE IMPACT OF THE PRICE SUPPORT PROGRAM UPON THE DEVELOPMENT OF THE POTATO INDUSTRY IN THE UNITED STATES

(Publication No. 7425)

Roger Winks Gray, Ph.D.
University of Minnesota, 1952

In order to provide a framework in which the impact of the price support program might be discovered, a study was made of the development of the potato industry in the United States over an extended period. This study revealed that rising per capita consumption and growing population prior to 1910 provided conditions favorable to the rapid development of the industry along lines of regional specialization, which culminated in a location pattern centering around the Great Lakes States. The rising per capita consumption was attributed largely to the influx of immigrants from European countries where potato consumption was very high in comparison with the United States. After 1910, with the sharp reduction in immigration, per capita consumption declined so rapidly that continued population growth did not sustain the demand for potatoes. Industry development, which now was taking the form of a shift from the Great Lakes States to such outlying specializing areas as are found in Maine, North Dakota, and the western irrigated areas, was affected by the contracting market in that the growth of regional specialization was retarded. The retarded rate of this development was related also to the higher risk associated with potato production on a highly commercialized basis, and to the absence of attractive alternatives to potatoes in the Great Lakes States. The development of regional specialization was illustrated in terms of the shift in production from these Great Lakes States to the outlying specializing areas.

The price support program, by reducing risk and providing the expanding market which had been absent since 1910, contributed to a rapid acceleration

in this shift. It was also found that the favorable prices of the major alternatives to potatoes in the Great Lakes region contributed to the accelerated development of regional specialization during the program period. A survey was conducted among the growers in several states in order to test several forms of the hypothesis that the development during the period was related to the price support program and concurrent economic conditions. The survey results provided support for the hypotheses tested.

An analysis of some interregional applications of the program was conducted in the framework provided by the foregoing analysis. It was here concluded that the restrictive phase of the price support period brought about some reversal of the economically desirable results achieved in the earlier, non-restrictive phase. A fuller appreciation of the impact that the program was having at the time might have resulted in improved administration during the later phase of the program.

A proposal for attacking the problem of risk in potato marketing was incorporated into the study. This proposal was defended on the grounds that it attacks the basic problem directly, is administratively uncomplicated, and involves no direct controls over the production decisions of growers.

Some further implications of the study may be that, for problems of this type, (1) considerations of price variability warrant greater attention relative to price level considerations, and (2) historical analyses of industry development may help to reveal significant relationships.

Microfilm copy of complete manuscript of 356 pages, \$4.45. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-683.

MANAGEMENT PROBLEMS OF INDIANA HATCHERIES

(Publication No. 7526)

Ronald L. Stucky, Ph.D.
Purdue University, 1954

This study consists of the following: a statistical standard of comparison of the operating results for different sizes and types of hatcheries in 1950; an analysis of some of the principal factors which affect the profitability of hatchery operations; and an analysis of some of the major management problems facing the industry.

Operating Results

Sales volume is an important determinant of net profit. Dollar profit increased generally in direct proportion with dollar sales. Total dollar investment also increased with increased volume but not at as rapid a rate. Consequently, the larger hatcheries obtained a higher ratio of net profit to total investment than did the smaller ones.

There was no significant association between

dollar sales volume and percentage of total income from chick sales. Firms relying on sidelines for much of their sales volume obtained about the same ratio of profit to sales as did those which concentrated on chick sales. Hatcheries concentrating on sidelines also obtained about the same ratio of net profit to total assets as did those which emphasized chick sales.

The number of chicks sold was the factor most closely associated with incubator capacity. The use of incubator capacity data as a measure of sales volume, net profit, or total investment may lead to major inaccuracies because there was little association between these factors and incubator capacity.

The 20 most profitable hatcheries studied had a sales volume which was three and one-half times as large as that of the 20 least profitable ones studied. Because of their ability to spread fixed costs over a much larger volume and apparently because of their stronger control over variable operating expense items, the most profitable hatcheries averaged a net profit of 7.0 percent of sales while the least profitable group made only 0.9 percent of sales.

Total costs per baby chick produced varied from 8.90 cents to 18.19 cents for the seven hatcheries in which detailed unit cost data were available.

Management Problems

The average dollar net profit of hatcheries which concentrated on broiler chick production was almost twice as large as that of hatcheries which concentrated on farm flock chick production. Nevertheless, farm flock chick sales still are profitable for a majority of Indiana hatcheries. Farm flock chick producers also avoid much of the difficulties of financing and marketing broilers for growers which broiler chick producers have encountered. Indiana farm flock chick wholesalers have experienced a period of rapid adjustment as a result of changes in the demand structure for their chicks in the southern states. Even the strongest of wholesalers sometimes have experienced difficulty in maintaining stable operations during this period.

The majority of hatcheries use farmer flock-owners as a source of hatching eggs because of the capital and management requirements of hatchery-owned flocks. This procedure has been satisfactory generally for farm flock chick producers; however, broiler hatcheries have been unable to obtain an adequate supply of eggs in the summer and fall because of the production problems associated with out-of-season egg production.

Instead of following a systematic procedure in the establishment of their promotional program, a majority of hatcheries use haphazard practices such as spending whatever cash is available or allocating an arbitrary percentage of sale volume. The few hatcheries which tailored their promotional efforts to specifically determined needs of their business obtained more effective results from their expenditures.

Observation of more successful hatchery operations indicated that numerous hatcheries could benefit by adopting one or more of the following

record keeping procedures: preparation of departmental sales and gross margin data, preparation of quarterly or monthly summaries of income and expense items, complete departmentalization of all operating expenses, use of a job-lot costing procedure for individual hatches, establishment of a standard cost procedure, and the keeping of additional non-dollar data such as unit chick sales and hatchability percentages.

Microfilm copy of complete manuscript of 174 pages, \$2.18. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-684.

ECONOMICS, COMMERCE — BUSINESS

LABOR UNION ATTITUDES AND POLICIES RELATING TO PRODUCTION STANDARDS AND WAGE INCENTIVES BASED ON TIME STUDIES

(Publication No. 5452)

Clifford Mason Baumbach, Ph.D.
State University of Iowa, 1953

An examination of the files of arbitrators and government regulatory boards in the area of labor relations discloses innumerable cases in which labor-management disputes over production standards and incentive wage methods have resulted in either work slowdowns or work stoppages. It is the objective of this study (1) to determine the minimum technical and human bases upon which incentive wage programs should be built, particularly in unionized plants, and (2) to formulate administrative policies to be applied to the many problems arising in any incentive wage program which will be acceptable to both enlightened managements and responsible unions and, thus, to minimize the frequency and severity of labor-management disputes in this area.

With this objective in mind, the investigation was divided into three fundamental steps. The first phase of the study involved the summarization of management's point of view, which forms the basis for the discussion of the incentive wage principle and its applications in the first two chapters. Chapter I describes the origin, nature, and development of time study and wage incentive methods, and chapter II is devoted to an explanation and illustration of these management-inspired techniques. The second chapter also summarizes briefly the problems which are common to all wage incentive schemes, for it is over the policies to be applied to these administrative problems that most of the controversy between labor and management arises at the present time.

The second aspect of the study involved the discovery and analysis of labor's sentiments, rationalizations, and policies with respect to these

"scientific management" methods. The primary data for this phase of the study was obtained from a mail questionnaire which was sent to each of the 64 national unions engaged in the negotiation of labor agreements in behalf of production and maintenance workers in American manufacturing industries. Forty-one union officials responded to the inquiry. The attitudes of organized labor toward time study and wage incentive methods are discussed in chapter III, and the various collective bargaining controls exercised by unions are presented in chapters IV and V.

Chapter IV deals specifically with two types of collective bargaining control by labor organizations: joint participation on an equal basis with management in the initial setting of standard production rates, and grievance negotiations to eliminate specific abuses in management's application of time study and incentive wage methods.

Since union policies and practice are often reflected in specific contract provisions, 77 representative labor agreements negotiated by unions which have had experience involving time study and wage incentives were analyzed to determine the frequency and characteristics of the various provisions relating to these techniques. The analysis of this third type of collective bargaining control is presented in chapter V.

The third phase of the study was concerned with the government's relation to labor and management in the formulation of time study and wage incentive policies. The National Labor Relations Board and War Labor Board rulings on time study and incentive wage questions are analyzed in chapter VI.

Thus, the conclusions and recommendations outlined in chapter VII are based upon a careful analysis of the points of view of three groups interested in and concerned with time study and wage incentive problems - management, labor, and the government.

Microfilm copy of complete manuscript of 346 pages, \$4.33. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-685.

EFFECTS OF DECENTRALIZED MANAGEMENT IN SELECTED INDUSTRIES

(Publication No. 7250)

Daryl Gordon Mitton, Ph.D.
University of Minnesota, 1953

Large manufacturing firms faced with a complexity of operations, diversification of products, and dispersion of activities must necessarily align their forces so as to secure economies of management and administration as well as economies of operation. This may be accomplished by properly designed organizational arrangements. The fundamental principle underlying effective organization is that of division of labor, coupled with the principle of comparative advantage. The limits of its application lie in the ability to coordinate the diverse

activities toward unity of purpose. The theme of centralization versus decentralization is used in this discussion because it affords a scale of practical values from one extreme to the other in organization structure.

Decentralization is interpreted as the delegation of authority to subordinates rather than simple departmentation or physical split-up of performance. Authority allocation can be made in any of the basic organization forms - that is, line, line and staff, or functional organization. Each form has its practical use, depending on the character of the firm. For most effective control in large firms with complexity of operations and products, the line and staff form appears to be best. To attain maximum accountability and control within this framework, each scalar level of line authority should have its own staff advisor over which it can exercise control.

The extent of decentralization within a company depends primarily on firm size and complexity of operations. However, other factors also play an important role; namely, management personalities and basic management philosophy which dominate the firm; the extent of the area covered by the firm - in terms of variety of products and geographic dispersal; the external economic and political trends prevailing; and the predominance of certain managerial functions.

Three company cases are cited to show the causes and effects of decentralization: The Ford Motor Company, International Harvester Company, and General Mills, Inc.

The Ford Motor Company is undoubtedly one of the most interesting cases of decentralization. This is because of the complete realignment of management that has taken place in the relatively short span of six years. In this time, the company has changed from a highly centralized one man control to a highly decentralized management with wide delegation of authority.

The International Harvester Company represents a case of organization transition from a highly centralized functional structure to that of decentralized line and staff. The case is made more interesting by the fact that the program of reorganization was never carried to completion. It illustrates well the impact of personality on organizational development.

General Mills, Inc., presents an interesting case in organization study because, historically, there have been trends both toward and away from decentralization. Their most recent reorganization represents an adjustment in order to provide sound control for their program of product diversification.

Each of these company cases of reorganization represents a change from a centralized functional structure to that of a decentralized line and staff (through product division) similar to the organizational pattern adopted by General Motors and Dupont some thirty years ago. Their methods of adoption and adaptation varied, naturally, presenting an interesting cross section of the needs and requisites of organization planning.

The advantageous effects of decentralization include:

1. Better utilization of managerial personnel.
2. Possible reduction of overhead costs.
3. Establishment of accountability.
4. Increased incentive, through linking effort with results.
5. Better executive development.
6. Flexibility of structure, facilitating organizational changes without changing basic structure.

These factors have enabled large organizations to overcome their unmanageability and actually work toward excellence in management.

Microfilm copy of complete manuscript of 239 pages, \$2.99. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-686.

EDUCATION

EDUCATION, GENERAL

TITLE: A STUDY OF THE VOCATIONAL REHABILITATION PROBLEMS OF TUBERCULOUS PATIENTS REFERRED FOR COUNSELING TO EDUCATIONAL AND VOCATIONAL COUNSELORS OF THE ANTI-TUBERCULOSIS LEAGUE OF KING COUNTY BETWEEN OCTOBER 21, 1946, AND SEPTEMBER 1, 1950

(Publication No. 7182)

Alma Viola Armstrong, Ph.D.
University of Washington, 1953

This thesis describes a Demonstration Rehabilitation Program of the Anti-Tuberculosis League of King County and analyzes the counseling records of 927 tuberculous people who were interviewed by the League counselors after having been referred by medical staff for assistance with their vocational rehabilitation problems.

Five hundred fifty-six of the 927 people had been interviewed for vocational counseling from three to thirty-three times each by the counselors, over periods of time ranging from seven to 1595 days, including in-sanatorium and post-sanatorium contacts. The medical records of these 556 people were also used as a source of data for this study. One hundred thirty-five of the 927 patients had been interviewed twice each, over a counseling time range of from two to 836 days each. The remaining 236 patients had been interviewed only once each.

A survey-questionnaire form containing 110 items was used to record data from the records of each of the 927 people. This information was coded and transferred to key-punch cards in order to facilitate tabulation and classification of the information contained in the forms, which allowed for as many as ten variables in some of the 110 items.

Data regarding the 556 patients who were interviewed more than twice are analyzed and presented separately from that dealing with the 371 patients who were interviewed once or twice. Data include identifying information, medical information, in-sanatorium vocational rehabilitation counseling information, information regarding services provided by the League to the patients other than counseling

services, and out-patient rehabilitation counseling information.

Four hundred fifty-one of the 927 patients on whom the study is based were males, and 476 were females. The marital status and number of dependents of each sex was essentially the same. The average age was thirty-four and seven-tenths years. The average age of the females was almost nine years less than that of the males. The age range was from five years to seventy-six years. Females averaged eleven years of education, as compared to ten years for males.

Approximately 80 per cent of these patients were in the sanatorium for their first and only admission at the time of the initial interview by the counselor. All of the patients had been discharged and none of them was in the sanatorium at the close of the study period on April 1, 1951. Approximately 64 per cent of these patients were discharged with medical approval. The length of time they had been hospitalized ranged from twenty-seven to 5436 days.

Twenty-one per cent of the 556 patients whose medical records were also used as a source of information had other types of tuberculosis, in addition to the predominant type of respiratory disease recorded upon admission to the sanatorium. The medical record also revealed that approximately 23 per cent of the 556 patients had from one to four other vocational handicaps, in addition to their tuberculosis.

One hundred sixty-four kinds of jobs in nine major occupations were represented in the major work experience of these people. Many patients changed vocational objectives during the course of vocational counseling. In general, vocational objectives were chosen from fields of work requiring higher education and more skill than had been demanded by the previous work experience of the patient.

The patients' rehabilitation problems were varied, personal, and changing. In many instances, the patients did not interpret their problems as the counselors, with medical advice, interpreted them. Seven categories of problems faced by the patients, as identified by both the counselors and the patients, included: need of vocational counseling, use of time in the sanatorium, need of services of other agencies,

alcoholism, physical handicaps other than tuberculosis, non-physical handicaps, and the need to arrest the patient's tuberculosis.

Microfilm copy of complete manuscript of 265 pages, \$3.31. Enlargements 6" x 8", 10¢ per page. Library of Congress card number Mic A54-687.

THE CONSTRUCTION AND ANALYSIS OF A GUIDE FOR EVALUATING ELEMENTARY SCHOOL BUILDINGS AND SITES IN CITIZEN SCHOOL SURVEYS

(Publication No. 7208)

Gerald Walter Boicourt, Ph.D.
State University of Iowa, 1953

The elementary score card as designed, used, and analyzed in this investigation was principally for the use of laymen in citizens' school building surveys.

In this study, the score card was designed in the following manner:

1. A list was made of all the items mentioned by six sources concerning the various aspects of the elementary school plant.
2. Items were included in the score card if they were mentioned by three or more of the sources used.
3. Items were then arranged in the experimental score card in the order that they would be encountered in a tour of the school plant.
4. The divisions and sub-divisions of the experimental score card were weighted so as to conform to the mean of the weighting given comparable divisions and sub-divisions in the Holy-Arnold and Strayer-Engelhardt score cards. In the case of individual items within such divisions and sub-divisions, no such comparison could be made. For this reason, individual items were weighted equally in most cases.

After the score card was constructed, it was used to evaluate twenty-six elementary schools. Each school was scored by a committee of five citizens who had no previous experience or training along this line.

Six of the schools evaluated were located in other states, and the scoring was done when the writer was not present. In such cases, written instructions were given the chairman of the group doing the scoring. In the case of the Iowa schools, the writer collected preliminary information concerning such things as room sizes, amount of light, etc., and entered this information on the data sheets of the score cards to be used. He then read the instructions to the group and asked them to score the building independently. The results were corrected for arithmetical errors that scorers may have made in addition or division.

Suggestions made by scorers as to ways of improving the score card, as well as some minor revisions in weightings, were incorporated in a revised score card which is included in the thesis.

Statistical analyses of the results were made in regard to:

1. The weighting of divisions.
2. The correlation of divisions and the correlation of divisions with the total score card.
3. The reliability of the score card.
4. The agreement of results obtained when school building specialists, using a conventional score card, scored the same buildings as the citizens' committees using the experimental card.

On the basis of such analyses, it was concluded that:

1. The weighting of all divisions closely reflected their discriminating power. A correlation coefficient of over .99 was obtained for the correlation between weight assigned each division and the effective weight for the division.
2. All divisions of the score card were very highly correlated, both with each other and with the total score card. Product-moment correlations ranged from a low of .72 to a high of .98.
3. The score card could be used reliably by citizens' committees. Rank-order correlations were obtained for two equivalent halves of the score card in such a way as to reveal inconsistencies due to sampling error, rater disagreement, or a combination of both. The correlation coefficient obtained here ranged from a low of .93 to a high of .98.
4. There was close agreement between the results obtained when school building specialists, using a conventional score card, evaluated the same buildings as a citizens' committee using the experimental score card. A rank-order correlation coefficient of .90 was obtained when the results obtained in thus scoring schools were correlated.

Microfilm copy of complete manuscript of 348 pages, \$4.35. Enlargements 6" x 8", 10¢ per page. Library of Congress card number Mic A54-688.

THE RELATION OF READING ABILITY TO COLLEGE MORTALITY OF CERTAIN ENTERING FRESHMEN AT THE UNIVERSITY OF WASHINGTON IN THE YEAR 1950-1951

(Publication No. 7186)

Lelwyn Clyde Breen, Ph.D.
University of Washington, 1953

The study attempted to determine:

1. The relationship of three reading test scores (vocabulary, speed and level of comprehension) of the Cooperative English Test Form C2, Higher Level, for 1914 Freshmen at the University of Washington in the year 1950-1951 to:
 - a. All-university average grades.
 - b. Average grades in twenty-six subject areas.
 - c. Eight independent variables which were:

Averages in high school - electives, English, foreign language, mathematics, natural science, and social science, and American Council of Education Psychological Examination test scores for the Quantitative and Linguistic Sections.

2. The relationship existing between reading test scores and failure at the University of Washington for this particular group.

3. Whether or not it was advisable to have remedial reading courses for individuals who score low in reading tests.

This study incorporated within it data of several prediction studies made previously at the University of Washington. These data were expanded to give a more precise and exact analysis of reading and to determine the variance controlled by reading in the various university and high school areas. A Basic Intercorrelation Matrix was prepared from derived intercorrelation coefficients. The Horst iteration method was used to compute the beta weights, the coefficients of multiple determination, and the standard errors for twenty-six subject areas, the all-university and high school averages, and the eight independent variables.

Several of the most important findings are indicated below.

1. The addition of the three reading variables to the eight increased the coefficients of multiple determination from -36.5 to 59.8 per cent of the variance accounted for by the eight independent variables. Also, when added to the eight, reading accounted for from -3.9 to 67.9 per cent of the total variance in grades. The total variance showed that the eleven, the three reading variables added to the eight, accounted for from .1726 to .8574 of the variance in the various university subjects. The eight variables accounted for amounts ranging from .1392 to .8274. The three variables as members of a three variable battery controlled from .0321 to .3531 of the variance in grades; but as members of an eleven battery controlled -.0152 to .2581 of the variance in grades. The coefficients of multiple determination indicated that the three reading variables controlled .0011 to .1331 of the variance in university grades. The proportion of the total variance accounted for by the three reading variables ranged from -3.9 to 67.8 per cent of the total controlled by the three reading variables in the eleven battery. This indicated that reading in some instances was being measured by the eight variables and that overlapping existed.

The βr products for the three reading variables for the university areas indicated that level and speed of comprehension were, in general, more important than vocabulary. Level of comprehension was consistent in its importance. Speed, as a single contributor, accounted for the greatest amount of variance in the high school areas, followed by level of comprehension, and by vocabulary which contributed negatively. The βr products for level of comprehension were relatively low. Speed of comprehension in the high school areas exceeded speed of comprehension in comparable university areas. The total variance for all-university average was .1828 and for high school average it was .0992.

Students with test scores below the means of the three reading tests had about a fifty-fifty chance of obtaining an all-university average of 2.00 point. Those above the means had about a three to one chance.

The total mortality rate for this group was 36.02

per cent and it appeared that reading may have been a contributing factor.

A generalization derived was that students who were low in a specific reading skill should be given training in this skill.

Microfilm copy of complete manuscript of 269 pages, \$3.36. Enlargements 6" x 8", 10¢ per page. Library of Congress card number Mic A54-689.

A REVIEW OF THE INFLUENCES BEARING ON THE DEVELOPMENT OF PROGRAMS IN INDUSTRIAL EDUCATION

(Publication No. 5464)

Walter Ernest Ditzler, Ph.D.
State University of Iowa, 1953

The purpose of this study was to investigate the influences bearing on the development of programs in industrial education. The term "industrial education" was chosen somewhat arbitrarily to include such related programs as manual training, manual arts, technical education, industrial arts, and vocational industrial education. The evolution of industrial education was traced historically for purposes of identifying all influences bearing on the development of related programs. As a preliminary step of the investigation, general histories of education, books dealing specifically with one or more phases of industrial education, and pertinent historical treatments in encyclopedias of education were studied to identify the influences believed by the various authors to have a bearing on the development of theory and practice in industrial education. After these influences had been listed, the Addresses and Proceedings of the National Education Association from 1857 to 1950 were critically reviewed for references to such influences in relation to programs in industrial education. Selected references bearing on each influence were organized and reported in chronological order, and in summary, within blocks of time as they related to each other.

It was found that such influences could be grouped under two main heads: (1) socioeconomic influences, and (2) the influence of changing educational theory. The socioeconomic influences were subdivided into the following sections: (a) the influence of wars, (b) the influence of the industrial revolution, (c) the influence of growing technological society, (d) the influence of problems caused by expansion of frontiers of America, and (e) the influence of attempts to prevent delinquency and to rehabilitate criminals. The influence of changing educational theory was investigated under the following headings: (a) the influence of changing concepts of the values and purposes of industrial education programs starting with the early manual training programs and continuing to the eventual development of industrial arts and vocational industrial education programs, (b) the influence of changing theories of the nature of mental development, and (c) the influence of changing methods of instruction in programs of industrial education.

A study of the Addresses and Proceedings of the National Education Association showed that all of these influences operated at some time in the period being investigated (1857-1950), and some of them persisted throughout these years. The relative emphasis placed upon any given influence, however, varied from time to time. The chief difficulty in depicting and evaluating the various influences in any period was found in the indefiniteness of terms used by speakers in referring to different types of programs. Although there were shifts in emphasis upon many purposes suggested as guides in the establishment of various programs of industrial education, there was a general, although uneven, trend toward the modern position, that if programs of industrial education are to meet current needs they must provide for both general industrial arts education and specific vocational education.

Microfilm copy of complete manuscript of 327 pages, \$4.09. Enlargements 6" x 8", 10¢ per page. Library of Congress card number Mic A54-690.

COMMUNITY RELATIONSHIPS OF BUSINESS TEACHERS IN THE HIGH SCHOOLS OF ILLINOIS (EXCLUDING CHICAGO)

(Publication No. 7034)

James Francis Giffin, Ph.D.
Northwestern University, 1953

The purpose of the study was to determine the participation of business teachers in community organizations and activities and the relationships they enjoy as a result of such participation.

The solution of the problem involved obtaining information bearing on the following: (1) relationships of Illinois business teachers with community organizations; (2) community business experiences of Illinois business teachers; (3) community-wide leadership activities of Illinois business teachers; (4) certain professional activities of Illinois business teachers; (5) conditions affecting business teacher participation; (6) the attitudes of business teachers towards participation; (7) values derived by business teachers from contacts with members of the community; and (8) attitudes of community residents toward business teacher participation.

The data for the study were obtained from questionnaires returned by 370 high school business teachers in Illinois. A number of personal interviews were made to supplement the results of the survey.

The memberships of business teachers in community organizations revealed that they have the same variety of community interests as citizens generally and that they are very much like teachers in general, so far as the number and kinds of their affiliations with community organizations are concerned. Except for the church, the majority of business teacher participations lie in the activities of the organizations closely associated with their work-day world.

Business teachers of Illinois are not organization

leaders as such. The mean number of memberships in community organizations was four, the mean number of leadership positions was one. About 14 per cent of the teachers reported membership in no community organizations whatever, but slightly more than half of the teachers had never been officers or sponsors of any community organization.

Almost half the business teachers have experienced employment of some kind in the community. About 11 per cent have served in an advisory capacity to businesses or have been owners of businesses.

About one-fourth of the business teachers have served their communities as chairmen of various charitable efforts, special events or campaigns, but very few of the teachers have had any part in community government.

The majority of the business teachers feel that too much time is required for school work to permit them to participate more extensively in community affairs, and the majority of the teachers wish to participate in more community activities. Most of them feel that participation contributes somewhat to teaching effectiveness. There is little evidence of the use of pressure to induce participation by business teachers. Most business teachers feel they are left pretty much alone, or are sought for participation on an equal basis of work and play.

By a small margin of preference, Illinois business teachers feel that social, civic and service organizations are the most professionally profitable avenue of contact with businessmen. They feel that contacts with the community are of greatest benefit in helping them to know parents and pupils as individuals.

The majority of business teachers feel they enjoy a moderate to high level of prestige in the communities where they teach, yet almost half of them are not sufficiently satisfied in their communities to want to remain there indefinitely. Almost half of the business teachers feel that their pre-service training helped some, but could have done more in preparing them for community relationships, and about one-third of the teachers felt that such training had been left entirely to chance. A good many of them presented definite ideas as to how preparation for community relationships could be improved.

Microfilm copy of complete manuscript of 251 pages, \$3.14. Enlargements 6" x 8", 10¢ per page. Library of Congress card number Mic A54-691.

A HISTORICAL AND STRUCTURAL SURVEY OF AUDIO-VISUAL TECHNIQUES IN EDUCATION, 1900-1950

(Publication No. 5478)

Maurice T. Iverson, Ph.D.
State University of Iowa, 1953

The purpose of this study has been to trace historically the use and development of audio-visual techniques as they have functioned in the educational procedures of the past half-century. The writer has classified and discussed them in the following order:

(1) Graphics and Still Pictures; (2) Realia, Field Trips, and Museums; (3) Radio and Recordings; (4) Motion Pictures; and (5) Television.

The use of graphics and other illustrative materials has become increasingly a part of classroom instructional procedures in recent years because of their ability to visualize and compare facts and present quantitative data in a condensed and appealing manner. Pictures, serving to assist in establishing correct concepts and a common background of experience to pupils at all levels, have been used extensively and made increasingly effective through the various means of projection.

The application of the Pestalozzian theory of sense impressions as a basic principle of instruction has brought about many first-hand, real experiences both within and without the classroom. Community resources, field trips, and museum collections have made the acquisition of factual knowledge more appealing and there is evidence that changed attitudes and appreciation for the natural and cultural resources of the community have resulted from their use.

Radio and recordings constitute sources of information beyond that of traditional procedures and are valuable in presenting historically and socially important events and personages into the classroom. Portable recording machines have proven to be of especial value in self-evaluation and motivation, and recording events that might not otherwise be available for future listening.

The use of the motion picture has undergone a phenomenal growth and has contributed to educational methodology. Television has introduced a new medium of communication which will have its impact upon school procedures.

Education at mid-century has made increasing use of audio-visual materials and techniques, but their full potentialities are only beginning to be realized. This study has explored the general historical growth of audio-visual techniques and their utilization in education in the United States from 1900 - 1950, collating heretofore widely scattered and little available materials.

Microfilm copy of complete manuscript of 350 pages, \$4.38. Enlargements 6" x 8", 10¢ per page. Library of Congress card number Mic A54-692.

**A STUDY OF THE RELATIONSHIP OF
SELECTED SOCIO-ECONOMIC FACTORS
TO OUTCOMES OF THE PROGRAM
OF GENERAL EDUCATION AT
MICHIGAN STATE COLLEGE**

(Publication No. 7166)

Carroll Milton Pike, Jr., Ed.D.
Michigan State College, 1953

This study is concerned with the evaluation of certain outcomes of the general education program at Michigan State College with particular attention being given to the effect of selected socio-economic factors upon those outcomes. Three newly devel-

oped objective-type evaluation instruments of the Cooperative Study of Evaluation in General Education, the Test of Critical Thinking - Form "A," the Inventory of Beliefs, and the Test of Critical Analysis in Reading and Writing, have been utilized in the study for the specific purposes of determining whether differences exist (1) between groups of entering freshmen, and (2) in the amount of change or gain during one academic year, when freshmen are classified according to (a) size of high school, (b) size of home community, (c) fathers' occupations, and (d) sex.

A sample of five hundred and ninety-six Michigan State College freshmen, tested for their representativeness of the total freshman class by means of the distribution of earned scores on the American Council on Education Psychological Examination, were used in the study. They were examined on the three evaluation instruments at the beginning and end of the academic year, 1951-1952.

Data analyzed consisted of pretest and posttest scores on the three evaluation instruments, selected biographical information, and A. C. E. scores, the data being collected, coded, and placed upon IBM punch cards for statistical analysis.

Gains in scores on each instrument made by the total sample of students during the academic year were studied by means of the "t" test of significance between correlated means. Differences in pretest or entrance scores for the various groups of students were tested by the analysis of variance technique. Differential gains among the various student groups for the academic year were analyzed by the analysis of variance, covariance adjustment technique.

For each of the three evaluation instruments statistically significant gains were found for the total sample of students during the course of the freshman academic year.

No significant differences were found among pretest or entrance mean scores for groupings of students within the high school, community, occupational, and sex categories as measured by the Test of Critical Thinking-Form "A," the Inventory of Beliefs, and the Test of Critical Analysis in Reading and Writing.

The study of differential gains for the academic year indicated a possible difference - significant at the 5-percent level of confidence - between men and women for scores on the Test of Critical Analysis in Reading and Writing with differences in pretest and A. C. E. scores controlled. However, this difference in favor of the women does not reach this level of significance if no correction is made for initial differences. No significant differences were found among mean gains made by groups within the other socio-economic categories for the Test of Critical Analysis in Reading and Writing, and no significant differences were found among gains within the high school, community, occupational, and sex categories for either of the other two evaluation instruments.

The results of this study lead to the conclusion that the socio-economic factors examined apparently have no measurable effect upon the extent or degree to which students benefit from emphases in the gen-

eral education objectives of critical thinking, maturity of beliefs and attitudes, and reading and writing abilities.

Microfilm copy of complete manuscript of 169 pages, \$2.11. Enlargements 6" x 8", 10¢ per page. Library of Congress card number Mic A54-693.

**A STUDY OF THE ORGANIZATION AND
ADMINISTRATION OF THE TEACHER
PLACEMENT SERVICES IN TEN
SELECTED UNIVERSITIES**

(Publication No. 7474)

Harold Eugene Sponberg, Ph.D.
Michigan State College, 1952

This investigation was undertaken to study the organization and administration of the teacher placement services in a selected group of major universities, in order to determine those placement procedures that appeared to be educationally sound and functionally effective, and to recommend those which appeared to be worthwhile and desirable.

The normative survey method was employed. The original data were obtained by means of the interview, interview outline and direct observation. The author visited each bureau and interviewed each placement director. Facts about the placement service and opinions of the directors comprised the data. Ten major universities in the north central region were selected for the study because of their comparable administrative organization, similar educational objectives, allied teacher training programs and corresponding levels of placement responsibility.

The teacher placement service occupied a significant position in the administrative organization of the university. Staff, office quarters and budget were provided by each university in facilitating the service. It was an integral unit in the teacher education program with seven directors serving as members of the staff in the schools of education.

The organizational structure of the placement bureaus presented little similarity in form or in administration. Seven different operational structures were used. Six bureaus were decentralized, three were centralized and one was set up on a coordinated, decentralized basis.

The decentralized organization appeared to be more closely integrated with the teacher education program; the directors and assistant directors developed a more functional working relationship with the personnel in professional education. The centralized organization may be more economical in regard to space, materials, clerical costs and staff salaries.

Administrative personnel in the bureau indicated a trend in up-grading their professional training with four directors and seven assistant directors pursuing the doctors degree. Teaching and administrative experience were desirable qualifications of the staff; their capacity to work with people on all levels of educational endeavor was basic to ef-

fective placement. Academic rank for the staff was desirable in order to give status and prestige to the placement service.

The approximate average budget allocation for each bureau was as follows: staff salaries, \$12,000; clerical personnel, \$9,000; operational costs, \$6,000. Compulsory registration for all graduating teaching majors improved the reliability of the service. The charging of a registration fee was considered to be an undesirable practice. Lack of adequate budget and staff restricted the operation of an effective follow-up program. Credential papers of all bureaus were similar in form and content; the quality of recommendations by faculty were generally unsatisfactory.

Services to the employers - school executives, boards of education, university officials - was as important as service to registrants. A definite increase in number of registrants for college positions was apparent; additional service was given to boards of education through institutes and conferences. All bureaus compiled annual reports; four made extensive studies of supply and demand of teachers and administrators. The administrative staff participated in the total teacher education program of the university through educational activities other than placement.

The following recommendations emerged from this study: (1) more active cooperation with the teacher education program; (2) administrative staff should be eligible for academic rank; (3) bureaus should be concerned about the recruitment as well as the placement of teachers; (4) research to determine the most effective organization of the placement services within a university; (5) the appointment of graduate assistants to the placement bureau; (6) research to determine the criteria for the position of director in a placement bureau; (7) research to determine the basis for more effective inter-institutional placement cooperation; (8) research to determine more effective use of occupational information, supply and demand data, population studies and follow-up procedures.

Microfilm copy of complete manuscript of 197 pages, \$2.46. Enlargements 6" x 8", 10¢ per page. Library of Congress card number Mic A54-694.

EDUCATION, ADMINISTRATION

**SCHOOL HEALTH RECORDS IN HEALTH
COUNSELING OF CHILDREN AND PARENTS**

(Publication No. 7482)

Charlotte Luise Ehling, Ed.D.
Stanford University, 1954

The purpose of this study was to discover why school health records in elementary school district X were not being used more effectively by the school personnel.

More specifically, the study was limited to the discovery and analysis of difficulties encountered in the use of the school health records for counseling parents about the health problems of their children, the medical correction of pupil health problems, and for the making of educational adjustments for pupils with health difficulties.

The study is a type of social science research of an exploratory nature. The identification of problems associated with the use of school health records constitutes the primary purpose of the study rather than the resolution of these problems.

The study was limited to the discovery and analysis of difficulties obstructing the use of those school health records published in the Nurses Manual¹, which is the recommended guidebook on school health records, sponsored by the county school department, and theoretically in use in elementary school district X.

The methods used in the study were: (1) a review of certain documents and printed materials available in the school district concerned with policies on school health; (2) a review of the literature regarding certain standards on school health; (3) the conducting of twelve one-hour exploratory, tape-recorded, and transcribed group conferences (one in each school of district X) involving approximately one-third of the entire school personnel of the district, and (4) study and analysis of the tape-recordings, so that emerging problems could be identified.

The participants in the discussion conferences included twelve principals, four school nurses, two speech correctionists, one audiometrist, a psychologist, and about eighty teachers of various grade levels from kindergarten to the eighth grade.

From an analysis of the data secured in this study, it is apparent that the effective adoption and application of the recommended San Mateo County school health record system in district X is hindered by two major factors: (1) the value and significance of the modern community concept of school health is not appreciated fully by administrators and, consequently, other school personnel in district X, and (2) trained leadership is lacking for guiding, coordinating, and supervising the total school health program, including the medical examination and school nursing parts of this program. As a result of these two major factors, difficulties (expressed and described in the data) arose among school personnel in interpersonal relationships, which caused confusion, frustrations, frictions, and apathy concerning health recording, health appraisal, and health counseling activities in district X.

Certain methods of approach, to promote better understanding and teamwork among school personnel for improved pupil and parent health counseling services, based on recorded health data, were suggested, such as: (a) enlargement of the present school health committee to include certain persons whose understanding and active cooperation are needed if "Responsibilities for Organization" published by the committee are to become operational, (b) consideration of the establishment of a central school health council for elementary school district

X, (c) consideration of the establishment of a health council for each school in elementary school district X, (d) consideration of the employment of trained, supervisory health personnel to direct, coordinate, and evaluate the various aspects of the total school health program, and (e) consideration of plans for in-service education programs of school personnel in the modern community concept of school health.

1. Nurses Manual, San Mateo County Schools. Curriculum Division San Mateo County Schools (San Mateo, California, July, 1952), pp. 66-114.

Microfilm copy of complete manuscript of 209 pages, \$2.61. Enlargements 6" x 8", 10¢ per page. Library of Congress card number Mic A54-695.

A PROGRAM FOR THE IMPROVEMENT OF ELEMENTARY EDUCATION IN IRAN

(Publication No. 7224)

Abbas Ekrami, Ph.D.
University of Minnesota, 1953

The thesis submitted to the Faculty of the Graduate School of the University of Minnesota has for its object "A program for the Improvement of Elementary Education of Iran". The study attempts to indicate a program of progress which will be of use to Iranians in the realization of proper objectives for Elementary Education in making provision for sending all the children of the country to the school and giving them opportunity to be benefited by the school for the period of common learning. The study also emphasizes that the transition from the traditional type of Education to a more effective and valid system of Education should be made as smooth and gradual as possible.

The information serving as a background for this study is discussed in two chapters. The first of these consists of a general description of historical background and cultural development of Iran, including a brief presentation of the manner in which the culture of the nation influences education. The second chapter serving as a background presents a short review of the literature in order to throw light on what has been presented by other writers for the improvement of elementary education.

A brief description of the organization of the Ministry of Education and elementary education is also presented to show the relation of the elementary schools to the national system of education under the direction of the Ministry of Education. Financial support of the school system and the growth of elementary education is given some consideration.

The factors related to the improvement of elementary education in Iran are divided, for the sake of faculty, into four main areas (1) The objectives of elementary education (2) The Curriculum (3) The teachers (4) The environment, equipment and facilities.

The discussion of each of these four areas follows roughly the same pattern. The practices in each of the four areas are described to give a picture of conditions as they now exist in elementary schools of Iran. This description is followed by a discussion of the procedures and objectives which are accepted by authorities in the field of education. Next, the educational practices in Iran are evaluated in terms of the accepted procedures and objectives. Finally, suggestions and recommendations are made for improvements in each of these areas as they relate to elementary education in Iran. Finally, suggestions and recommendations concerning the various aspects of elementary education is presented.

Microfilm copy of complete manuscript of 443 pages, \$5.54. Enlargements 6" x 8", 10¢ per page. Library of Congress card number Mic A54-696.

A STUDY OF SCHOOL BOARD ELECTIONS IN SANTA CLARA COUNTY

(Publication No. 7493)

William Ellis Gould, Ph.D.
Stanford University, 1954

This study seeks to present data regarding the reasons why persons become candidates for the board of education, what methods they use in campaigning or otherwise promoting their chances of election, and what may be the factors determining the outcome. In addition, information is presented in regard to the sorts of persons who become candidates, the composition of the electorate in school board elections, and the active participation of the school administration and community organizations in the elections. Most of the information has been gathered by the personal interview technique.

In Santa Clara County, California, during the years of 1946 to 1953, the majority of school board elections were non-competitive, with the incumbent returned to office without opposition, if he could be prevailed upon to take the thankless position for another term. If not, there was the tendency on the part of the remaining board members and the district superintendent to seek out some desirable citizen and prevail upon him to become a candidate, also often without opposition.

In cases of vacancies, usually created by resignations or retirements, the county superintendent appointed the new office-holders. Approximately a third of all trustees in the county in 1953 had at one time held office under appointment from him.

During the 1946-1953 period there were 99 school trustee elections in which there were more candidates than there were positions to be filled. The attempt was made to contact all of the 238 candidates participating, representing 264 individual candidacies. The interviews, conducted by standard journalistic techniques, represented 225 candidates. The majority of them belonged to the more-favored classes of the population, socially and economically.

They said their candidacies had been prompted by the urging of friends, neighbors or persons connected with the schools. In secondary reasons for candidacy, advanced by the candidate or ascribed to him by his opponents, a wide variety of motives were revealed, ranging from geographical considerations to religious affiliations.

The campaign methods used for school trustee candidates leaned heavily upon word-of-mouth, face-to-face personal contact, with organization being the key to success. Three groups appeared, numerically, as the likely bases for campaign organizations: the school administration, the school teaching staff and non-certificated employees, and the Parent-Teacher Association. An analysis of the electorate participating in the 1952 elections showed numerically disproportionate participation by these groups. The registration in Santa Clara County showed a female majority.

Reasons given by the candidates for the election outcomes stressed the advantage of the incumbent, active support by the school administration and Parent-Teacher Association as outweighing the individual qualifications of the candidate, the nature of his campaign or his position on educational issues, the campaigns usually being publicly conducted on generalities. Among secondary factors, cited by candidates or their opponents, the religious issue emerged with considerable frequency.

The professional school executives of the County were found to be active in dealing with their constituents under what they called "public relations" techniques, but there was no accepted agreement as to the limitations of this form of activity and in a number of instances it tended to enter the realm of politics.

The study was limited to one County, although it presented a wide variety of elections. Extraordinary conditions existed in the County by reason of phenomenal growth of the suburban areas, causing the school attendance to double in the seven-year period studied. This tended to accelerate the tempo with which school problems arose and to accentuate them, but few data were produced to indicate that this had any profound effect upon the nature of the school elections held, the motivation of the candidates participating, or the outcomes.

Microfilm copy of complete manuscript of 252 pages, \$3.15. Enlargements 6" x 8", 10¢ per page. Library of Congress card number Mic A54-697.

A STUDY OF ELEMENTARY SCHOOL ORGANIZATION

(Publication No. 5473)

Richard Gordon Hansen, Ph.D.
State University of Iowa, 1953

The purpose of this study was to investigate the opinion of classroom teachers and prospective teachers in regard to two teaching situations. The

first situation was one in which there would be a maximum of twenty-eight children per classroom insofar as it was practical to do so. The teacher would be responsible for instruction in all areas of the curriculum. In the second teaching situation a maximum of thirty-eight children per classroom would be maintained where practical to do so. In this situation the teacher would receive free time in the amount of 250 minutes during the teaching week by the provision of special teachers who would be responsible for instruction in art, music, and physical education.

A second purpose of this study was to analyze the effect the introduction of a plan or organization similar to the second situation described would have upon the number of teachers and the number of classrooms that would be needed to care for future predicted enrollments of one particular school system.

A questionnaire was constructed which would allow classroom teachers to express an opinion in regard to their choice of these two teaching situations and provide information as to their training, experience, and the like. The superintendents of ten school systems presented this questionnaire to the elementary teachers of their schools along with a memorandum which implied that the issues involved in these two plans of organization for instruction were being considered by local school authorities. A questionnaire similar to that used for classroom teachers was presented to students in four colleges preparing for teaching positions.

The Mason City schools were used to determine what effect the introduction of a plan of organization that would provide for special teachers and larger classes would have upon the number of teachers and the number of classrooms that would be needed to care for predicted future enrollments. Data for this portion of the investigation was secured by interview and observation and from the superintendent of schools.

The data presented in this study would appear to support these contentions:

1. Even though there seems to be a definite trend toward acceptance of the self-contained classroom plan of organization for instruction, a large number of teachers as well as prospective teachers indicated a preference for a plan of organization which would provide special teachers in art, music, and physical education.

2. The teaching situation similar to the self-contained classroom was most strongly supported by those teachers who (a) had four years of college training, (b) had the least teaching experience, (c) had the least experience with teachers in the special subjects, (d) had slightly the best preparation in art, music, and physical education, (e) were now teaching the smallest classes, and (f) were teaching in the primary grades.

3. This situation was most strongly favored by those students who (a) were in their first two years of college training, (b) were planning to teach in the lower grades, (c) were going to be slightly better prepared in the special areas, and (d) felt little

hesitancy to handle instruction in these subjects.

4. The teaching situation which would provide special teachers for art, music, and physical education was most strongly favored by those classroom teachers who (a) had two, three, or more than four years of college training, (b) had the most teaching experience, (c) had the most experience with special teachers, (d) had slightly less preparation in art, music, and physical education, (e) were now teaching the larger classes, and (f) were teaching above the primary level.

5. This situation was favored more strongly by those students who (a) were in their last years of college training, (b) were planning to teach above the primary grades, (c) were going to have slightly less preparation in the special areas, and (d) were more hesitant about their ability to teach the special subjects.

6. Teachers included in this study would appear to be rather poorly prepared in art, music, and physical education since more than half of the teachers have had no more than two courses in each of these areas.

7. The adoption of a plan of organization which would allow a larger class size would make it possible to provide special teachers in art, music, and physical education and would reduce the number of classrooms that would be needed to care for predicted future enrollments.

Microfilm copy of complete manuscript of 257 pages, \$3.21. Enlargements 6" x 8", 10¢ per page. Library of Congress card number Mic A54-698.

LEARNING OUTCOMES OF SIXTH GRADE PUPILS UNDER ALTERNATE GRADE ORGANIZATION PATTERNS

(Publication No. 7484)

Charles Thomas Hosley, Ed.D.
Stanford University, 1954

The Problem:

Various patterns of grade organization have been tried during the past century. Expansion of the curriculum, vocational education, and extension of the educative process have created pressures upon the traditional 8-4 pattern of grade organization. One device used in developing new patterns was to split the traditional 8-4 pattern at the sixth grade level. In many instances, the effects upon the learning outcomes of the pupils was not the prime factor in the establishment of these new patterns. The study of the learning outcomes of sixth grade pupils under alternate grade organization patterns is the problem of this dissertation.

Procedure

The learning outcomes of approximately two hundred sixth grade pupils in a semi-departmentalized 6-7-8 grade school were compared with the learning outcomes of a similar group of sixth grade pupils in

six K-6 schools. The two groups were equated by selecting pupils whose communities, schools, teachers, and individual mental aptitudes were similar.

The educational programs in both types of schools were studied by using a questionnaire in which the teachers described their programs, and by direct observations of the programs in action. The major difference in the two types of program were: (1) the 6-7-8 grade school had special teachers for art, music, science, library, and physical education, while the teachers in the K-6 schools taught all subjects, (2) the 6-7-8 grade school had a special intra-class grouping plan for reading, whereas grouping for reading was done within the classroom in the K-6 schools, and (3) a greater variety of special art, music, library, physical education and social activities were available to the pupils in the 6-7-8 grade school.

The California Achievement Tests were used to measure pupil growth in achievement. Pupils in the K-6 schools made significantly greater gains in achievement during the year, but there was no significant difference in grade placement scores of the two groups at the end of the year. Therefore, the findings concerning academic achievement were inconclusive. The "t" test of significance was used in this study to measure differences.

Six characteristics of social behavior (cooperation, friendliness, leadership, integrity, responsibility, and critical thinking) were measured by the Behavior Preference Record. No significant differences that could be traced to grade organization patterns were found between the two groups of pupils. Two further measures of social adjustment and pupil activity used were the "What I Believe and Do" Test and the "My Friends and Hobbies" Test. Pupils in the 6-7-8 grade school scored significantly higher on interest in pleasure reading, they participated in a greater diversity of activities, and had more hobbies than did the pupils in the K-6 schools.

These findings indicate that if special facilities for activities are provided, (1) the pupils participate in a greater variety of experiences than do the pupils in schools where these facilities are not provided, and (2) that interest in pleasure reading is fostered by including library instruction as a regularly scheduled part of the curriculum.

Conclusions:

The findings of this study did not show that one organizational pattern was superior to the other in influence upon the learning outcomes of sixth grade pupils. This may be attributed to the following factors: (1) there are no significant differences, (2) the nature of the sample, (3) the limitations of time (one year), and (4) the lack of suitable instruments to measure many areas of pupil growth i.e. creative arts and social participation. Comprehensive research, over a longer period of time, and with instruments measuring a greater variety of learning outcomes, is needed to study the effects of grade organization patterns upon the learning outcomes of pupils.

Microfilm copy of complete manuscript of 151 pages, \$1.89. Enlargements 6" x 8", 10¢ per page. Library of Congress card number Mic A54-699.

THE ADMINISTRATION OF PUBLIC SCHOOL INSURANCE AFFAIRS

(Publication No. 7485)

John Russell Kent, Ed.D.
Stanford University, 1954

The problem undertaken in this study is that of identifying, analyzing, and evaluating insurance practices of the school districts of Redwood County, California (a fictitious name for the actual county studied) as a basis for making recommendations for improving the administration of insurance matters. The purposes of the study are:

1. To identify current practices relative to insurance affairs in a California county.
2. To analyze the affect of such practices.
3. To evaluate such practices in terms of established criteria.
4. To make recommendations for improving administration of insurance programs in the school districts included in the county studied.
5. To define what appears to be a sound theoretical distribution of responsibilities for school insurance affairs among the three basic administrative levels: state, intermediate or county, and local district.

In the twenty-eight districts studied, policies and procedures in handling insurance affairs were investigated by reviewing records and contracts, and through extensive personal interviews. Attention was directed particularly to relationships between patterns of administrative policy and procedure and effectiveness of insurance programs.

Insurance programs were found to be defective in more than half the districts studied. Common defects were: inadequate property valuation data, discrepancies between amounts of insurance carried and amounts required by coinsurance stipulation, policy non-concurrency, premium rate discrepancies, overlapping coverage, selection of insurers of unproved financial stability, and failure to provide fidelity bond protection as required by law.

It was concluded that inadequacy in insurance programs resulted from one or more of the following circumstances:

1. Failure to make one school official responsible for handling insurance affairs.
2. Lack of technical knowledge and understanding of insurance by school officials.
3. Lack of competent technical advice on the part of insurance purveyors.
4. Lack of any alternative source of technical advice.
5. Placing insurance business on a patronage basis.

6. Failure to maintain adequate records.

The following are among recommendations made for improving the administration of insurance affairs:

1. That responsibility in each district be definitely placed. In smaller districts with minimal administrative organizations it is unrealistic to expect the administrator to assume major responsibility. The first step in improving administration of insurance affairs in such districts is recognition that improvement is unlikely without outside assistance. This is significant, for the majority of California's 2,000 districts are too small to maintain specialized administrative staffs.

2. That a concise manual on the administration of insurance affairs be prepared, perhaps as a joint venture of the Business Officials' Association, the Trustees' Association, and the California Department of Education.

3. That training programs for school business administration include instruction in insurance principles and in the administration of the school insurance program.

4. That each school district adopt a definite policy for the distribution of its insurance business. Two basic questions must be answered: How can the district secure an adequate and economical program? And which agents are to participate and upon what basis?

5. That school insurance business be handled as public business. Those who render a service to the district are entitled to be paid for their services, but no individual has any special rights. The handling of insurance on a patronage basis is intolerable.

It was concluded that the state's responsibility in insurance affairs is primarily twofold: to determine minimum standards, and to disseminate information. The county or intermediate district has a triple responsibility: to act as a coordinate agency in enforcing minimum standards, to assist in actual administration in those districts too small to maintain administrative staffs of their own, and to provide advisory resources to all districts. Within the framework of minimum standards, this leaves the local district primary responsibility for determining and implementing its own policies.

Microfilm copy of complete manuscript of 155 pages, \$1.94. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-700.

FACTORS AFFECTING THE ACADEMIC SUCCESS OF FOREIGN STUDENTS IN AMERICAN UNIVERSITIES

(Publication No. 7252)

Forrest G. Moore, Ph.D.
University of Minnesota, 1953

This study attempts to evaluate some of the factors which may effect the achievement of foreign students in the colleges and universities of the

United States. An idea of the diversity of the foreign student group is gained through a general analysis of the total foreign student group attending American universities from 1948-49 to 1951-52 and a special analysis of graduate foreign students in twenty-three American graduate schools by broad areas of study and countries of origin. It is clear that individual educational institutions do not attract a proportional sampling of foreign students when sex, area of origin, field of study and graduate-undergraduate status are factors considered. China and India are the two countries which have sent the largest numbers of graduate students to the United States and at Minnesota the fields of study of agronomy-plant genetics, civil engineering, economics, and political science enroll the largest groups of foreign students.

The intensive case studies of seventy-six foreign graduate students attending Minnesota during the 1951-52 academic year showed that of the many factors affecting achievement, motivation is one of the most important and must be understood if academic achievement is to be realistically assessed. The case studies gave evidence that among the causes of poor achievement of foreign students are the factors of English language deficiency, lack of motivation, delayed or improper vocational choice, and "cultural imbalance."

There is evidence that the problem of giving grades reflecting accurately the student's performance is intensified for this group of students. The variation in grades given in some departments is reduced by the use of the "S" mark which appeared to decrease the use of the "A" and "C" marks.

In the section of the study dealing with achievement of 516 foreign graduate students as measured by honor-point ratio (HPR), a number of statistical tests were used. The comparisons involving the mean achievement of foreign students offer the best measure of the outcomes of the study when two of the three variables of country of origin, field of study and degree earned, are held constant. Sufficient numbers of students from China and India with HPR distributions homogeneous in variance were available for intercountry comparisons and it was shown that the achievement of students from China and India earning the master's degree with designation in the field of civil engineering differed significantly at the one per cent level in favor of the Chinese students. Students from these same two countries earning the doctorate in the field of study of agronomy-plant genetics did not achieve at significantly different HPR levels.

Comparisons were also possible between groups of Indian and Chinese students in different fields of study. Chinese students in entomology earning the Ph.D. achieved at a significantly higher level of HPR than did Chinese students in agronomy-plant genetics show no significant difference in achievement when compared to Indian students earning the doctorate in plant pathology. Chinese students earning the master's degree with designation in aeronautical engineering and civil engineering achieved at a significantly higher HPR level than did Chinese students in chemical engineering.

The comparisons of achievement of American and foreign graduate students gave no clear instances of statistically significant difference. Chinese students in aeronautical, civil, and electrical engineering averaged HPR's above those of American students, but fell below American student achievement in agronomy-plant genetics, entomology, chemical engineering, agricultural economics and economics. United States students ranked consistently above Indian and Norwegian students in the comparisons made.

Microfilm copy of complete manuscript of 619 pages, \$7.74. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-701.

REPORT CARD PRACTICES AS VIEWED BY HIGH SCHOOL PUPILS AND TEACHERS

(Publication No. 7486)

Quirino Louis Paolazzi, Ed.D.
Stanford University, 1954

The purpose of this study is to discover where the disagreement between senior high school students and high school teachers lies regarding current marking and reporting practices. The problem was attacked by exposing those aspects of marking and reporting practices that are perceived differently by students and teachers. The importance of modifying or if necessary eliminating those aspects and characteristics causing teacher-student dissatisfaction is based on the following:

- 1) If teachers and students can agree on certain difficulties associated with present marking and reporting practices and can isolate some of these sufficiently to make necessary revision, the result will lead to improved teacher-student rapport.
- 2) Cooperation on the part of students and teachers in formulating report cards is democratic practice and can improve home-school relations.
- 3) A common understanding between the student and teacher in determining aims, objectives and achievement will assist to improve school morale and thereby contribute to greater effectiveness in instruction.
- 4) A successful method of reporting to parents can help each student to grow in his own way. An improved report to parents can serve as a useful instrument of guidance.
- 5) If the teacher-student rapport can be promoted through improved marking and reporting practices; parent and teacher relations may be similarly improved.
- 6) The technique of discovering attitudes toward reporting practices may prove fruitful in helping to devise a more practical report card for secondary schools.

The data used have been obtained through the questionnaire method. The questionnaire items were formulated from controversial aspects of marking and reporting practices posed by authorities

in educational administration.

High schools participating have been selected on a random basis by including California schools ranging in A. D. A. of fewer than 500 students to more than 2,000 students. Diversity of teachers and students was further insured by including in the study high schools organized under the "8-4", "9-3" and the "10-2" plans of administration.

Identical questionnaire forms were used for senior high school students and teachers. There were 1075 questionnaires distributed among students enrolled in social sciences classes in the high schools participating and 250 questionnaires to teachers of social science in those same high schools. There were 1050 or 97.67 per cent returns from the students; and 240 or 96 per cent returns from the teachers.

The responses to the questionnaire items have been treated statistically and percentages have been given in order to facilitate the interpretation of the data presented. A Chi Square (X^2) test of level of significance using a fourfold contingency table has been employed.

The thirty-three questionnaire items have been grouped under the following seven major categories: (1) Teacher-Student Attitudes on Current Methods of Reporting, (2) The Principal Purpose of the Report Card, (3) The Effect of Reporting Practices on Teacher-Student Relationships, (4) The Effect of Reporting Practices on Student-Parent Relationships, (5) Personal Effect on the Student, (6) Participation in the Formulation of the Report Card, and (7) The Effect of Reporting Practices on Parent-Teacher Relationships.

Since it was the purpose of this study to determine where the disagreement between teachers and students regarding current marking and reporting practices lies, the findings have been reported under the following classifications:

Section I includes those items with which students and teachers agree. The items have been grouped in terms of proportional agreement as follows: (1) Teachers agree more strongly than students, (2) Students agree more strongly than teachers, and (3) No significant degree of difference in agreement has been exposed; Section II includes those items with which both students and teachers disagree. The items have been grouped in terms of proportional disagreement as follows: (1) Teachers disagree more strongly than the students, (2) Students disagree more strongly than the teachers, and (3) No significant degree of difference in disagreement has been exposed; and Section III includes those items where the majority of students disagree with the majority of teachers.

According to the findings of this study students and teachers seem to agree with the following statements that:

1. The high school should include in its report to parents items concerning character and personality development;
2. Grades and report cards serve as incentives for students to do better work;
3. High school students should be encouraged to

judge their own work and be given an opportunity to put to use many kinds of talent in the classroom;

4. Persistently low grades reported to the parent should serve as an incentive for the parent to contact the school;

5. Report cards should provide sufficient space for parents' comments;

6. The high school report card should be signed by at least one parent or guardian before it is returned to the school; and

7. The purpose of the report card is essentially to indicate to parents the academic progress of the student;

According to the findings of this study students and teachers seem to disagree with the following statements that:

1. The report card used is so clear that there is no need to ask about the meaning of its content;

2. Relationships between students and teachers are adversely affected because of grades reported to parents;

3. The high school should report only the student's academic progress in such subjects as English, history, math, science, etc.;

4. High school students should have a voice in determining what grades should be assigned for character and personality traits to be reported to parents;

5. Grades and report cards foster ill feeling among students, parents, and teachers; therefore, they should be abolished;

6. The feeling of being "free" of grade worries would result in stepped up performance and effort on the part of the student;

7. Repeated low grades in a certain subject tend to destroy the respect of the student of the teacher of that subject;

8. Teachers spend too much valuable time preparing and recording grades for reporting purposes; and

9. High school report cards should be mailed to the home rather than be sent home by the student.

The ultimate usefulness of the findings of this study will depend largely on its contribution toward the improvement of future marking and reporting practices adopted by the secondary school. Such contribution could be achieved by:

1. Placing greater emphasis on those characteristics, factors, and conditions wherein strong agreement has been found to exist among teachers and students,

2. Subjecting to further study those items which do not reveal definite agreement on the part of teachers and students,

3. Subjecting to further study those items which do not reveal definite disagreement on the part of teachers and students, and

4. Determining, experimentally, the effect which items showing strong disagreement between teachers and students may have on teacher-student rapport and on home-school relations.

If the problem of disagreement between high school students and teachers on marking and reporting practices and its effect on teacher-student rapport

is now met, a heuristically valuable hypothesis can be stated:

The higher the extent of teacher-student agreement on basic aspects of reporting methods, the higher the teacher-student rapport.

Microfilm copy of complete manuscript of 138 pages, \$1.73. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-702.

AN EVALUATION OF THE DUTIES AND RESPONSIBILITIES OF A SMALL DISTRICT SUPERINTENDENT OF SCHOOLS IN A SELECTED MIDWEST AREA

(Publication No. 7473)

George Spencer Pritchard, Ed.D.
Michigan State College, 1954

Important areas of school administration were determined by the amount of space given to these issues in current books in school administration. From these principal areas, eleven standards of satisfactory administrative practice were formulated and validated. These standards were then used as a basis for the construction of an interview guide for the use of the six interviewers used in this research.

The following is a summary of the findings and conclusions of this study:

1. In the areas of the selection of personnel, the board of education plays a major role and the superintendent a minor role. Complete board domination was found in 56% of the cases in the selection of teaching personnel, and in 42% of the cases in the selection of non teaching personnel.

2. In the area of school finance the board of education retains much of the administrative control. In 47% of the schools surveyed, the power of the superintendent of schools is greatly checked by the board in the preparation of the budget and the purchasing of supplies.

3. The superintendent spends as much time in actual teaching as in administering the school system. All of the superintendents included in this study listed teaching as one of their major duties. On the average they spend 45% of their time in the classroom.

Cooperative action between the board of education and the superintendent of schools is necessary for effective school administration. Any deviation from this generally approved practice may result in an unstable educational program.

This thesis is an investigation of the practices and techniques of school administration in current use in small district school systems in Eastern Nebraska and Western Iowa. Specifically, the purpose of this study was threefold: (1) to determine the practices in the different areas of school administration now in use in small district schools, (2) to evaluate these procedures in the light of administrative practices approved by leaders in education, and (3) to discover areas of school management that

experienced teachers in these small schools feel need improvement.

Data were obtained by means of personal interviews with board members, superintendents, and teachers on current school administrative procedures, and on the improvement of these procedures. School board members and superintendents in each community were asked in separate interviews to describe their procedures in each area of school management. These two answers were then cross checked to increase the accuracy of the study. Sixty school systems were selected at random in this Midwest area to participate in this study.

4. Most schools completely ignore teachers in the formation of administrative policies. Even in the field of curriculum construction, where the teacher's specialized training would be of considerable value, only 16% of the teachers in the sixty schools surveyed were allowed to assume even a minor role in policy formation. In only 23% of the schools surveyed do the teachers play a part in the formation of the salary schedule for the school system.

5. In the areas of board and superintendent relations, where participation and cooperation have been used to arrive at administrative policies, there has been less dissatisfaction expressed than where one group makes the decision alone.

Microfilm copy of complete manuscript of 247 pages, \$3.09. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-703.

FOLLOW-UP DATA AND CURRICULUM REORGANIZATION IN A UNION HIGH SCHOOL DISTRICT

(Publication No. 7487)

Edward Thomas Walsh, Ed.D.
Stanford University, 1954

Purpose

The purpose of this study was to collect follow-up data to aid in curriculum reorganization in the two older schools (San Mateo and Burlingame) of the San Mateo Union High School District as well as to aid in curriculum building in the District's two new high schools (Capuchino and Hillsdale).

Method

The follow-up questionnaire was designed to secure general data (present address, marital status, present activity, and armed services experience) from the graduates as well as information on the post high school education and employment experiences of the graduates. The respondents were also asked to evaluate their high school subjects, extra-curricular activities, and counseling services.

A pilot study was conducted to test the questionnaire. The final questionnaire form contained thirty-one illustrations. The graduating classes of 1947, 1950, and 1952 were selected for study. Post card reminders and phone calls were used to

increase the number of responses.

Responses

A total of 1512 questionnaires were mailed to the graduates. Five hundred sixty-three (37.2%) of the questionnaires were returned. The boys and girls returned questionnaires to almost the same per cents. The more recent the year of graduation, the higher was the per cent of return. A study of the graduation quartile standing of the respondents indicates that the academically successful are more inclined to return questionnaires than their less successful classmates.

Summary, Conclusions, and Recommendations

1. The data reveal that 73.1% of the respondents still reside within the District. The vast majority of the respondents have continued to reside, work, and take up further schooling near home. The schools must analyze the local employment and college situations and prepare the graduates to meet local requirements.

2. One-third of the male respondents reported armed services experience. All physically qualified boys will enter the armed services under the Armed Forces Reserve Act of 1952. The schools must help to prepare the boys to meet this responsibility.

3. Most of the girls continue to work after marriage. All girls should be prepared to work outside the home even though they plan to marry upon high school graduation.

4. Approximately two-thirds of the respondents reported post high school education. Seventy per cent of those pursuing further schooling continued their education at a local junior college, a nearby state college, or two nearby universities. The District high schools must establish close relations with these nearby institutions to aid the smooth movement of the graduates into higher education.

5. The respondents reported English and mathematics as the subjects of most value in college work, on the job, and in everyday living. This response should encourage the teachers of these areas to renewed enthusiasm and effort in the presentation of their subjects.

6. The graduates who had gone on to college indicated a need for additional preparation including experience with comprehensive types of examinations, preparing term reports, note taking, and outlining.

7. The graduates suggested new courses be offered in the Psychology and Sociology and Human Relations area and in the Preparation for Marriage and Human Reproduction area.

8. The respondents reported numerous benefits of their own high school extra-curricular activities participation and recommended greater participation for all students.

9. The respondents reported dissatisfaction with the counseling services in the areas of vocational guidance, educational guidance, inadequate counseling time, and lack of personal interest on the part of the counselors. Careful screening of counselors and

increased counseling time would help to remove these types of complaints.

10. The employed respondents are working almost entirely in the skilled, clerical, and sales fields. The schools must develop strong departments in these fields related to the greatest vocational possibilities of the graduates.

The method used in this study has universal application. The findings are of value primarily to the District involved. The value of the study will be determined by how well the findings are used in curriculum reorganization in the schools of the District.

Microfilm copy of complete manuscript of 323 pages, \$4.04. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-704.

EDUCATION, HISTORY

AN HISTORICAL ANALYSIS OF THE DEVELOPMENT OF THE USE OF COLLATERAL READING FROM 1900 TO 1950

(Publication No. 5479)

Edward James Kelly, Ph.D.
State University of Iowa, 1953

The purpose of the present study was to investigate the development of the use of collateral reading in the teaching of history from 1900 to 1950.

For the execution of this study the following were assumed to have been factors in the development of the use of collateral reading:

1. The reports of a number of national committees such as the Committee of Ten, the Committee of Eight, and the Commission on the Social Studies.
2. The ideas of educators such as Charles McMurry, Henry Johnson, and others.
3. The development and utilization of certain general teaching methods such as the topical method, the source method, and the problem method.
4. Research findings pertaining to the limitations of the textbook and to the value of extensive reading.

In order to fulfill the purpose of this study, these factors were explored extensively; and the purposes served by collateral reading were historically reviewed. Furthermore, an historical analysis was made of the availability of collateral reading materials and the time provided for their use.

The major emphasis in the study was on the first eight grades. Eleven basic sources of information provided most of the data utilized. In this study, collateral reading was understood to include both reference material and imaginative literature.

The data appear to justify the following conclusions, subject to the conditions of the investigation.

1. In various ways and to various degrees, contributions to the development of the use of collateral

reading were made by the reports of certain national committees such as the Committee of Ten, the Committee of Eight, and the Commission on the Social Studies; by the ideas of various educators such as Charles McMurry, Henry Johnson, and others; by the development and utilization of certain general teaching methods such as the topical method, the source method, and the problem method; and by a variety of research findings pertaining to the limitations of the textbook and to the value of extensive reading.

2. The use of collateral reading was recommended continuously from 1900 to 1950. There was some tendency for it to be emphasized at different times for different general purposes; however, its use was recommended throughout the period for the purpose of combating verbalistic learning and memoriter methods as well as for the achievement of atmosphere, reality, interest, and cultural enrichment. After 1925, considerable emphasis was given to the use of collateral reading for the purpose of providing for individual differences in reading ability.

3. Collateral reading materials were never available in recommended quantities during the period covered by this study. The reports of sixty-eight school surveys which had been conducted during the period under study revealed that most of the elementary school libraries surveyed were inadequate and that the best of these libraries surveyed were only fairly adequate. Furthermore, there was never enough time provided for adequate collateral reading. In 1945, history and the social studies area received in the sixth grade average weekly time allotments of less than 140 and 360 minutes respectively. It is evident that very little classroom use could be made of collateral reading under these circumstances.

The following recommendations were made:

1. Every effort should be made to supply each school with an abundance of collateral reading materials.
2. In acquiring collateral reading materials, cognizance should be taken of quality as well as quantity.
3. More school time should be provided for the use of collateral readings.
4. The fact that dull children as well as gifted children can profit from collateral reading should be recognized.
5. Precautions should be taken to insure that classroom teachers do not confuse extensive reading with superficiality. Actually, intensive study involves extensive reading.

Microfilm copy of complete manuscript of 341 pages, \$4.26. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-705.

EDUCATION, PHYSICAL

THE RELATIONSHIP OF DEPTH PERCEPTION
TO GOAL SHOOTING IN BASKETBALL

(Publication No. 5462)

Joseph Fletcher Dickson, Ph.D.
State University of Iowa, 1953

The purpose of this study was to determine whether tests of depth perception make a contribution to the prediction of basket-shooting ability.

The subjects were twelve varsity basketball players, eleven good intramural basketball players, and twelve poor intramural basketball players.

Each subject used in this study had normal vision at both the far and the near point.

The goal shooting tests in this study consisted of each subject taking fifty shots at the goal from fifteen and twenty-one feet directly in front of the goal with twelve foot-candles of light at the level of the goal. This test was repeated with two foot-candles of light at the level of the goal.

In each of the tests involving shots at the basket, the attempts were scored on a four-point scale.

If a shot was short of the ring or landed beyond the ring it was scored 3. Any attempt landing on the front edge or back edge of the ring was scored 2. If a ball on a goal attempt hit the inside of the front or the inside of the back of the ring, it was scored 1. Any attempt going through the basket without touching the ring was scored 0. The score for each of the tests involving shots at the basket consisted of the sum of these weightings, regardless of whether the ball entered the basket.

Five tests of depth perception (Howard-Dohlman test, distance-judgment test of the American Automobile Association, a ping-pong test, a picture test, and a string test), and one test of kinesthetic control (blind-shooting test), were administered.

The findings in this study would appear to warrant the conclusion that the five tests of depth perception do not measure the factors of depth perception requisite to basket-shooting ability.

Microfilm copy of complete manuscript of 70 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-706.

EDUCATION, PSYCHOLOGY

LEADERSHIP BEHAVIOR IN
COLLEGE SOCIAL GROUPS

(Publication No. 7483)

Carroll Vernon Galbreath, Ed.D.
Stanford University, 1954

This study sought to discover the patterns of leadership behavior preferred by members of

fraternities and sororities at the University of Denver. Background for the study was provided by a survey and synthesis of the vast literature on leadership. A comprehensive list of leadership traits considered important in democratic social groups was extracted from the literature. Simple, direct descriptions of the behavior by means of which existence and operation of these traits in a leader would be perceived by his followers were constructed to form a questionnaire. Adverbs reflecting frequency of behavior were provided for the respondents to check in describing their leaders' actions, and an item for indicating the respondent's over-all evaluation of his leader was added.

The questionnaire was administered to 166 fraternity men, representing nine groups, and to 181 sorority women, representing seven groups. The leaders whose behavior was described were the retiring presidents.

Scores for each of the 95 items included in the questionnaire were computed according to the responses of the total population and then separately for men, women, lowerclassmen, and upperclassmen. These item scores were determined by comparing item responses with the evaluation of the leader's general effectiveness. It was then possible to arrange the items in rank order of relative strength for each population segment studied and to draw conclusions related to the types of leadership behavior preferred by the various groups.

The review of the literature of the field indicates that:

1. Leadership is a transitory function of the constantly changing social setting in which it occurs.
2. Much difficulty in understanding leadership is due to the lack of a definitive terminology for describing traits, groups, and situations.
3. Known transfer of leadership capacities and skills from one situation to another justifies our efforts to train leaders.
4. Democratic leaders are not greatly different from those they lead. Such leaders are effective when they promote cooperative effort and when they groom followers to take their places.
5. The research most urgently needed is systematic analysis of the leadership behavior demanded by many particular kinds of groups.

The present study finds that:

1. Fraternity and sorority presidents are not equally accepted by all members.
2. Students, particularly women, tend to become more critical of their leaders as they grow older.
3. Leader behavior serving to weld the group together in an atmosphere of pleasant association and willingness of the leader to sacrifice his personal goals for the welfare of the group was highly desired.
4. Observance of custom, convention, and tradition by the leader was considered relatively important. Positiveness, assertiveness, and independence of action by the leader was less likely to earn approval.
5. Personal characteristics of physical strength

or athletic eminence were found to occupy an extremely low order of importance among the attributes studied.

6. Inspiring loyalty to the group was found to be a much more important leadership technique when the group was defined as the individual fraternity than when it was defined as the university.

Implications for education and for student personnel administration were drawn. Student groups must be studied more thoroughly, using more reliable techniques, if real understandings of the motivations of such groups are to permit their use as educational facilities. Leadership training is feasible to the extent that specific leader behaviors can be identified. The content of the leadership training program must be based on the observed facts of leader behavior rather than on broad generalities and philosophical assumptions. Guided and supervised experience is perhaps even more important than didactic training. Followership training is equally feasible and equally desirable for strengthening our present form of government and way of life.

Microfilm copy of complete manuscript of 193 pages, \$2.41. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-707.

A NORMATIVE STUDY OF THE REVISED STRONG VOCATIONAL INTEREST BLANK FOR MEN

(Publication No. 7283)

Theda Hagenah, Ph.D.
University of Minnesota, 1953

The present study was undertaken to provide counselors with normative data on the Revised Strong Vocational Interest Blank for Men.

The measured interests of college freshmen were studied through an analysis of the profiles of a sample of 1,000 freshman men who completed the Revised Strong Blank in the first quarter of registration. These profiles were selected from testing in the years 1939, 1940, and 1941 in the College of Science, Literature, and the Arts, the General College, and the Institute of Technology of the University of Minnesota. The number drawn for each college to comprise the sample of 1,000 was proportional to the enrolment of men in the freshman classes in the three colleges for the three years.

The existence of interest patterns and types in the 1,000 profiles was judged according to the technique established by Darley's previous work with the unrevised Strong Vocational Interest Blank. Only those patterns and types reported by at least two of three judges were included in the distributions.

Results may be summarized as follows:

1. The sample of 1,000 profiles was shown to be representative of freshman men enrolled in the College of Science, Literature, and the Arts, the General College, and the Institute of Technology of the

University of Minnesota, across time and within college, on high school rank and raw score on the American Council on Education Psychological Examination.

2. A high order of percentage agreement among three judges was obtained on the reporting of primary and reject patterns within interest types. A lesser order of agreement was found for the observation of secondary patterns within the various types.

3. Normative data for the sample of 1,000 profiles and for the sub-samples from the three colleges included frequency of occurrence of primary, secondary, and reject interest patterns and types, and frequency of simultaneous occurrence of primary and reject patterns.

4. Normative data on reject patterns of interests dissimilar to those of persons successfully engaged in various occupations provided useful information not previously emphasized. In interpreting profiles, the counselor should consider reject, as well as primary and secondary patterns.

5. Although there were similarities from college to college in the frequency of primary, secondary, and reject interest types, the rank ordering of types showed considerable "natural selection" for the three colleges. Natural selection was most clearly seen in the differences of rank ordering of interest types in the College of Science, Literature, and the Arts and the Institute of Technology.

6. Mean standard scores and sigmas on the three non-occupational keys for the various interest types were presented as additional normative data. The null hypothesis that no differences existed on these personality correlates among the various interest types was tested and cautiously rejected; results were regarded as approximative in instances where the assumption of homogeneity of variance was not satisfied as a condition for the analysis of variance.

7. Claimed occupational choices were allocated to the most appropriate factorial group under a high order of agreement in the judgment of two psychologists. Normative data were presented on frequency of the resultant "stated interest types" for the composite sample and for the three colleges, again showing a degree of "natural selection." Several null hypotheses of relationship between stated and measured primary interest types were tested and rejected.

Microfilm copy of complete manuscript of 163 pages, \$2.04. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-708.

THE RELATIONSHIP BETWEEN READING
ABILITY AND THE USE OF COMMUNICATION
MEDIA BY ADOLESCENTS

(Publication No. 7238)

Roberta Anna Evalin Johnson, Ph.D.
University of Minnesota, 1953

The purpose of the investigation was to determine whether adolescent boys and girls and superior and inferior readers among boys and girls differ with respect to total consumption of content from three communication media - newspapers, radio, and television, and in consumption of kinds of content within each medium. Media offerings were classified according to eight psychological values - physiological, social, egoistic, emotion-security, recreatory, practical, cognitive, and moral-spiritual. Selections made on this basis were identified as interests.

Two related experiments were conducted. Members of the first experimental group, consisting of 75 girls and 69 boys, were users of the Minneapolis Morning Tribune for Monday, October 9, 1950. The second experimental group, consisting of 85 girls and 75 boys, were users of the Minneapolis Star, an evening paper, for Wednesday, October 25, 1950. The sample group for each experiment was selected by quota sampling within stratified geographic areas of the City of Minneapolis.

The significance of mean differences between sexes and between superior and inferior readers of each group were determined by appropriate statistical tests. The method of analysis of covariance permitted control of chronological age and mental ability and the determination of influence of these two characteristics in consumption of media offerings.

With the doubtful exception of radio consumption it was concluded that boys and girls are using the three communication media to a similar extent. Sex differences in perusal of interests were identified in the use of radio and newspaper but not in use of television. While the differences were not significant in the majority of analyses, a trend was indicated in that of a total of thirty analyses the mean was greater for the girls in twenty-four cases, with three of the six analyses in which boys read more classified as concerned with egoistic values.

Reading ability was shown to influence total selection of newspaper content for two of the groups analyzed, although for one group it appeared that the combined effect of mental ability and chronological age was operant in pointing up the difference and for the other the combination of factors was determinant. Reading ability was not found to be significant with respect to total use of radio or television. Differences between superior and inferior readers were identified in some instances as significant with respect to type of content selected in the newspaper but not in the media of radio and television. Differences between superior and inferior readers were significant or approaching the 1%

level of significance for each category save that of social value in one or more analyses. The results were not consistently significant for all groups.

When differences between superior and inferior readers were found to be significant, it appeared that the control of factors of mental ability and chronological age identified real differences rather than determined them. Differences noted as significant or approaching the 1% level of significance were always in favor of superior readers. Again, although not proven statistically, a trend was discernible. Of a total of fifty-six different analyses between superior and inferior readers, the greater mean was in favor of superior readers in forty instances.

It was found that television users did not differ significantly from non-users of television in amount of newspaper consumption. A significant difference in favor of non-users of television was found with respect to total radio listening.

Microfilm copy of complete manuscript of 290 pages, \$3.63. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-709.

A FOLLOW-UP STUDY OF COLLEGE
TRAINED VERSUS NON-COLLEGE TRAINED
HIGH SCHOOL GRADUATES OF HIGH ABILITY

(Publication No. 7266)

Edward Orley Swanson, Ph.D.
University of Minnesota, 1953

After discussion of the aims and objectives of a college education a summary list of objectives was set forth. It was hypothesized that, other things being equal, the college educated person should show a higher degree of those characteristics and more of those behaviors which have been specified as the goals of a college education than does his educationally less favored counterpart. "Other things being equal" refers to "aptitude for college" as measured by high school scholarship achievement and by a college aptitude test.

It was shown that a CAR of 80 or better constituted a good college risk. For the years 1926-1929, 94 male high school graduates who met this standard were located and interviewed in 1950-51. Four groups emerged in terms of subsequent amount of college education: Group I did not go to college; Group II started college but did not complete it; Group III received a bachelor's degree only; and Group IV received a bachelor's degree plus graduate and/or professional degrees. Group III and Group IV were often combined and called the college graduate group.

Marriage patterns showed a higher mean age of first marriage with more education; however, mean number of children was nearly equal. Assortative mating with respect to wife's educational level was apparent for all groups.

Number of, and length of, jobs held showed no

trend, but the college group started work at higher job levels and moved into higher level jobs faster. Median salaries and salary ranges stayed together until World War II began, from this point on the college graduates moved ahead.

In military service the college graduate group had more who had served, and of those who served, they had served longer. They also started and completed their military careers at higher levels.

In politics the college graduates were more active and engaged in a wider range of political activities. They were also more active in charitable organizations. Activities in the church and in civic organizations, however, showed no trends or few differences.

Those with more education read more out of town newspapers, less sports and comics columns, and more national, state, and political news. They reported reading more of the better magazines. Absolute amount of fiction or non-fiction reading, however, did not differ much. But the upper educational groups reported buying and using the public library more often as source of books they did read. Radio and television ownership were even for all groups, but phonograph ownership showed more ownership with more education.

With more education there was less participation in indoor card games but more attendance at concerts and stage plays, forums, lectures, and legislative assemblies. Those with more education had traveled more often and visited a wider variety of places.

The college aptitude test-retest, after 24 years, showed all groups gained significantly, but gains were significantly greater for college groups III and IV.

As there were: (1) several statistically significant trends; (2) many noticeable trends, though not statistically significant; and (3) practically no reversals of trends; all in the direction as expected by the major hypothesis, it is concluded that college education makes a favorable difference in the post-school lives of high school graduates.

Microfilm copy of complete manuscript of 226 pages, \$2.83. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-710.

THE FUNCTION OF THE MMPI IN DETERMINING FITNESS FOR STUDENT TEACHING AT THE NURSERY SCHOOL, KINDERGARTEN, AND PRIMARY SCHOOL LEVEL

(Publication No. 7275)

Earl Theodore Zwetschke, Ph.D.
University of Minnesota, 1953

The purpose of this thesis was to discover the contributions which the MMPI could make toward better prediction of teacher success or competency at the nursery, kindergarten and primary school level.

The subjects in the study were students in the University of Minnesota College of Education, registered in the nursery, kindergarten and primary school curriculum. They were divided into two groups: (1) the original group, consisting of those students completing student teaching during the two years, 1950-52; and (2) the cross-validation group, including those who completed student teaching during 1952-53. The criterion of teaching competency was a measure combining grades in student teaching and ratings of student teachers by supervisory teachers.

Relationships were determined between the criterion of teaching competency and honor point ratio, standard scores on the Miller Analogies and the Cooperative Reading tests, and results on the Minnesota Multiphasic Personality Inventory. For the comparisons with the MMPI, three methodological approaches were used: (1) individual scale analysis; (2) item analysis; and (3) a profile analysis.

Both the original group and the cross-validation group were considered in the analyses, and only those factors which were significant in both groups were employed in the final step of the study, the development of a multiple regression equation for predicting teaching competency of nursery school, kindergarten, primary teachers. No result of any analysis was considered significant unless it held for both groups of subjects.

Of the three methods used for analyzing the MMPI, the profile analysis produced the most stable and significant measure of relationship to the criterion of teaching competency. Three qualitative relationships between MMPI scales were found to be significantly related to teaching success at the level studied. As interpreted, the relationships meant that: (1) the better teacher, although somewhat more sensitive and anxious about herself, is more realistic in meeting her problems than the less successful teacher, and (2) the better teacher is more enthusiastic, active and resourceful than she is authoritarian in her plans and activities, while the poorer teacher tends to be more autocratic in her attitude and behavior than she is productive and resourceful in her planning.

A multiple regression equation was developed which utilized the two best predictors in the study: (1) honor point ratio for the freshman-sophomore years, and (2) a profile score developed from the three significant MMPI scale relationships. The multiple correlation of .525 between the two independent variables and the criterion of teaching competency was not extremely high, but was considered to be a good estimate of the relationship, as both variables were significantly related to the criterion at the one per cent level of confidence in both the original and the cross-validation samples. The Beta value of each variable in the multiple regression analysis was also significant at the one percent level of confidence.

The item analysis methodology produced a scale that was also significantly related to the criterion of teaching success, although the scale did not significantly contribute to the multiple regression

equation which utilized honor point ratio and profile score for predicting teaching competency.

No significant relationships were found between the criterion of teaching competency and any of the scales of the MMPI considered singly. One strong trend was in evidence, however, for both the original and cross-validation samples, a trend in the direction of greater femininity of interest for the better teacher. With a somewhat broader interpretation, the trend could mean that the better teacher is less authoritarian and perhaps more democratic in her attitudes and values.

Microfilm copy of complete manuscript of 220 pages, \$2.75. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-711.

EDUCATION, TEACHER TRAINING

THE IMPERATIVES OF THE COMMUNITY SCHOOL CONCEPT FOR STUDENT TEACHING PROGRAMS

(Publication No. 7164)

Leon Morris McClure, Ed.D.
Michigan State College, 1953

During the past twenty-five years the literature in many of the areas of the social sciences and in education has reflected the concern of many writers with what they see as an increasing tendency toward disunity, segmentalization, general weakening of traditional social values, and widespread cultural and institutional instability in the current society. This tendency has been cited as undesirable and has been viewed with general alarm. One of the theoretical developments in the field of public school education that has evolved as a partial response to these social and cultural characteristics has been the community school concept. It has been based primarily on the hypothesis that the nature of the common education provided by a society for its members determines at least in part what the characteristics of that society shall be.

A further basic hypothesis has been that in order to have a significant influence upon the fulfillment of the indicated societal needs, education must seek its objectives from and be closely and realistically involved in the social processes operating in any given community.

The present study attempted to show that the nature of the teaching done in community schools is sufficiently different to require a reorientation of teacher education. It considered one phase of the professional education of teachers for community school service - the area of student teaching.

The social background of the community school concept was reviewed and the concept was defined. Competencies to be desired in community school teachers were developed from the literature and

were also logically developed from the definition of the community school. Examples of teaching units and school-community projects that had been reported were described and analyzed for their similarity to units and projects that would be a part of an actual community school.

The literature as indicated above, the definitions of the community school, and the illustrations noted in the preceding paragraph served as the source of the logical imperatives for student teaching programs that were finally developed. These were expressed as principles and may be summarized as follows:

1. The schools in which student teachers are assigned should be carefully selected in terms of the degree to which their curricula, methodology, administration, and general philosophy appear to be sufficiently flexible and community oriented so that teacher candidates could have experiences somewhat similar to those they would have in a community school.

2. The student teaching experience should be accompanied by a parallel laboratory experience where groups of student teachers may work together with a faculty coordinator.

3. The student teachers should live in the school community during their student teaching experience.

These principles were developed in such a manner that each one could logically be at least a partial solution to the imperative needs of prospective teachers being prepared for community schools.

The study recognized some of the major blocks that might have to be considered in the implementation of the proposed student teaching program. Emphasis was directed toward the need for further research and study in many of these areas.

Microfilm copy of complete manuscript of 141 pages, \$1.76. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-712.

EDUCATION, THEORY AND PRACTICE

THE EFFECT OF THE SYSTEMATIC ANALYSIS OF ERRORS ON ACHIEVEMENT IN THE STUDY OF FRACTIONS AT THE SIXTH GRADE LEVEL

(Publication No. 7211)

Orville Bendolph Aftreth, Ph.D.
University of Minnesota, 1953

The Problem

The problem was to determine to what extent the identification and correction of typical errors embedded in nineteen sets of cumulatively constructed exercises in addition and subtraction of fractions affected learning of these processes. Pupils in experimental groups were required to identify and correct typical errors in worked-out examples, while the control groups worked the same examples as practice exercises. The study was designed to test the

following basic null hypothesis: There is no difference between experimental groups and control groups in their ability to add and subtract fractions under the treatments mentioned above. The hypothesis was tested in terms of the criterion variables based on immediate recall tests and delayed recall tests.

The Design and Statistical Analysis of the Major Investigation

Seven classes with 289 sixth grade pupils from the Robbinsdale, Minnesota, public schools participated in the main study that began November 10, 1952 and ended February 19, 1953. The tests used to evaluate outcomes included: (1) The Kuhlman-Finch Intelligence Test - Grade VI; (2) The Coordinated Scales of Attainment - Arithmetic Computation; and (3) Brueckner's Comprehensive Tests in Addition and Subtraction of Fractions. All of the tests satisfied the criteria of validity and reliability. The analysis of variance and covariance as a single classification with unequal numbers in the sub-groups was applied to the data collected from two experimental and two control classes to determine the variation attributable to method and error and at the same time remove the effects of intelligence, arithmetic computation ability, and prior knowledge of fractions. The analysis of variance and covariance as a two-way classification with unequal numbers in the sub-groups was applied to the data collected from three split classes (each randomly divided into two sections) to determine the variation attributable to method, teacher, interaction of teacher and method, and error and at the same time remove the effects of the covariables mentioned above.

The Findings

The sixteen subsidiary null hypotheses derived from the basic null hypothesis were in general accepted at the five per cent level of significance. However, the null hypothesis based on the analysis of covariance with the delayed recall test in subtraction of fractions as the criterion variable was rejected in the single classification analysis. The null hypothesis based on the analysis of the variance and covariance with the immediate recall test in subtraction of fractions as the criterion variable was also rejected in the two-way classification analysis.

Conclusions

The following general conclusions may be drawn:

1. No statistically significant differences due to method were found in the experiment in the addition of fractions.
2. Statistically significant differences due to method were found in two of the four analyses in the experiment in subtraction of fractions.

Implications for Teaching

The outcomes of this study suggest that the following new avenues of approach are possible in the teaching of fractions:

1. The exposure of children to the process of identifying and correcting errors in practice

exercises in addition and subtraction of fractions will not affect learning adversely in the early stages of learning in these processes.

2. In order to provide a wide variety of learning activities the classroom teacher may include experiences in detecting and correcting errors systematically in these processes. This procedure may not be effective during the later stages of learning an operation.

3. Instruction in the addition and subtraction of fractions based upon the procedures outlined in the text, *Arithmetic We Use*, Grade 6, and upon systematic practice exercises prepared for this experiment resulted in post-test mean scores that were actually within a few raw score points of complete mastery.

4. The possibility of expressing growth in terms of growth units (isochrons) should be explored.

Microfilm copy of complete manuscript of 351 pages, \$4.39. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-713.

THE ROLE OF THE LABORATORY AND DEMONSTRATION IN COLLEGE PHYSICAL SCIENCE IN ACHIEVING THE OBJECTIVES OF GENERAL EDUCATION

(Publication No. 7216)

Louis William Balcziak, Ph.D.
University of Minnesota, 1953

The major aim of the study was to determine the role of the laboratory and demonstration in college physical science in achieving the objectives of general education. Specifically, the problem resolved itself to comparing the relative effectiveness of three instructional methods in physical science laboratory. The experimental sections were taught by either the demonstration method, the individual laboratory method, or the combined demonstration and individual laboratory method.

The writer formulated the following objectives for general education of the college physical science course:

1. To develop a functional understanding of scientific facts, principles and laws.
2. To develop scientific attitudes, interests and appreciations.
3. To develop skill in the functional use of scientific instruments and apparatus.

The experiment was carried out during the Fall, Winter and Spring Quarters of 1952-1953. All subjects in the experimental study were students enrolled in Physical Science 101, a general education course in physical science at Mankato State Teachers College. Two day sections of twenty four students each were used each quarter and the forty eight students involved were randomly assigned at the time of registration before the beginning of each quarter.

A 2 x 3 randomized block design with equal subclasses was used in this investigation. The

experiment was controlled carefully with respect to the instructional time, the subject matter, audio-visual aids, laboratory apparatus and experiments, and the evaluation instruments.

Information on the initial status of the students was obtained by means of honor point ratio, the ACE Psychological Examination and three pretests: Science Information, Scientific Attitude, and Laboratory Performance. The achievement criteria were three final tests given at the end of each quarter as follows: Science Information, Scientific Attitude, and Laboratory Performance.

In the experimental design, the following three null hypotheses were tested:

1. There is no difference between the three methods of teaching physical science laboratory work in achieving the objectives of general education.
2. There are no differences that are traceable to the differences in replications.
3. There are no differences that are assignable to the interaction between methods and replications.

The experimental data were subjected first of all to the univariate analysis of variance and covariance. The effects of the following variables were statistically partialled out by the use of covariance techniques: ACE, the Science Information Pretest, the Scientific Attitude Pretest, and the Laboratory Performance Pretest. Upon completion of the statistical analysis, the three null hypotheses were accepted with respect to the three criterion measures.

Secondly, the experimental data on the three criterion measures were subjected to the multivariate analysis of variance and covariance. The effects of the following variables were statistically partialled out by the use of covariance techniques: ACE and the Laboratory Performance Pretest. Upon completion of the statistical analysis the three null hypotheses were accepted with respect to the three criterion measures.

On the basis of the experimental evidence, the experimenter recommends that present instructional practices in the general education physical science laboratories be modified in the following manner. If the general education curriculum requires a basic understanding of facts, principles and laws in physical science, then a combination of individual laboratory and demonstration will be satisfactory. If the general education curriculum involves, in addition, the development of scientific attitudes, interests and appreciations, then the combined method mentioned will be sufficient. If a functional understanding of scientific apparatus and equipment is the aim of the general education course, then the combined method of laboratory instruction should be used in physical science.

The experimental evidence showed that none of the three instructional methods proved to be superior in achieving the objectives of general education. One can conclude that the individual laboratory and demonstration played equivalent roles in achieving these objectives. To motivate and stimulate interest in present day scientific problems on the part of the student, it is recommended that as many proven

instructional procedures as possible should be used.

Microfilm copy of complete manuscript of 183 pages, \$2.29. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-714.

CRITICAL FACTORS INVOLVED IN THE EVALUATION AND USE OF OCCUPATIONAL INFORMATION IN AGRICULTURE IN THE NORTH-CENTRAL REGION

(Publication No. 7157)

Tollie Raymond Buie, Ed.D.
Michigan State College, 1953

The Problem

The purposes of this study were: (1) to determine the critical factors of occupational information in agriculture desired by teachers of vocational agriculture, (2) to determine the same factors desired by the students of vocational agriculture, (3) to develop an evaluative instrument for evaluating occupational information in agriculture, and (4) to evaluate the available inexpensive occupational information in agriculture.

Method of Study

An analysis was made of 21 characteristics of occupational information commonly discussed in the occupational literature to determine those desired by either a significant proportion of the 51 selected teachers of vocational agriculture or their 2,150 students of the North-Central Region (thirteen states).

Two questionnaires were prepared, one for the teachers and the other for the students. In addition to the 21 characteristics previously mentioned related factors pertaining to occupational information, which concerned only the teachers or the students, were included in the respective questionnaires. The teachers answered and checked their questionnaires and directed the students in their classes to check individually a copy of the student's questionnaire. These data were summarized and analyzed for three high-school class groups and for teachers.

Findings

The teachers and students recognized the teaching value and importance of current and reliable occupational information for assisting individuals in choosing a vocation.

Colored pictures, rather than black and white pictures or the absence of pictures, were preferred by a significantly greater number of teachers and students.

A combination of paragraph and outline form, rather than paragraph form or outline form only, was preferred by a significantly greater number of teachers and students.

Information presented in tabulated form was preferred, rather than "disliked" or considered

"unimportant," by a significantly greater number of teachers and students.

The remaining 18 characteristics of occupational information were rated "very important," "important," and "unimportant"; significant differences existed in the percent of students preferring all of the characteristics, except one. This one exception was highly significant to the teachers. Also, the differences in the percentages for five of the 18 characteristics were not significant for the teachers but these five were highly significant to the students.

All of the selected characteristics were used in the development of the instrument for evaluating occupational information, and the percentage of students and/or teachers preferring each item was highly significant.

A test of reliability in the use of the evaluative instrument was performed by computing the correlation coefficients for three selected pamphlets. The average scores for each characteristic given by five teachers of vocational agriculture were correlated with those given by five counselors. The correlations were: +.92 for pamphlet I, +.97 for pamphlet II, and +.91 for pamphlet III. These coefficients were significant at the 5 percent level.

A second test of reliability of the instrument was made by collecting, evaluating, and preparing an annotated bibliography of the inexpensive occupational information pamphlets in agriculture. The results obtained by the use of the evaluative instrument were highly satisfactory.

The annotated bibliography revealed the adequacy of coverage of materials on the agricultural and related occupations.

A significant number of teachers preferred to integrate occupational information in their classes. Also, they recognized the teaching value of the various sources of information.

A negative correlation coefficient of .1541 was computed between the teachers' expressed need for and the students' interests in materials on production occupations; the reverse existed concerning farm service and other related occupations, i.e., a positive correlation coefficient of .4013.

The students indicated their most likely choice of an occupation with 72 percent in farming, 19 percent in occupations related to farming, and 9 percent in nonagricultural occupations.

Fifty-three percent of the teachers revealed that they were using field trips extensively in teaching occupational information in agriculture.

Sixty-five percent of the teachers reported unsatisfactory filing systems for printed materials.

Microfilm copy of complete manuscript of 250 pages, \$3.13. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-715.

THE USE OF ANALYSIS OF VARIANCE IN ESTIMATING THE COMPONENTS OF VARIATION IN AN EXPERIMENTAL STUDY OF LEARNING: TEXTBOOK-CENTERED VERSUS LABORATORY-CENTERED APPROACH IN THE TEACHING OF INTRODUCTORY HIGH SCHOOL CHEMISTRY

(Publication No. 7246)

William Harrison Lucow, Ph.D.
University of Minnesota, 1953

Problem and Populations

The experimental study of learning reported in this thesis compared the effectiveness of a textbook-centered approach with a laboratory-centered approach to the learning of introductory high school chemistry. The variance produced in the groups was of special interest. Model II analysis of variance was used to estimate the components of variance in the results.

The experimental subjects were drawn from accelerated and non-accelerated pupils attending Lord Selkirk high school in Winnipeg, Manitoba, Canada. The accelerated and non-accelerated pupils were considered to have been drawn from two distinct populations, and the experiment was run separately for each sample.

Method

A pilot study was made during 1951-52, one year prior to the execution of the experimental design, for the purpose of developing a criterion examination on the chemistry course. This examination was finally put into the form of two tests, one to be administered at mid-term, and the other at the end of the experimental period. Subsequent testing showed that the test-retest reliability of the criterion examination was 0.95. As a validity check, the examination correlated with an outside criterion, the Anderson Chemistry Test, with a coefficient of 0.66, significant at the one per cent level.

The main experiment took place from September, 1952, to March, 1953. Thirty-six accelerated pupils were placed at random into textbook and laboratory groups of eighteen each. Twenty-four non-accelerated pupils formed textbook and laboratory groups of twelve each.

The testing program included the administration of the criterion examination as a pre-test and an after-test, a special practical examination, and tests of mental ability, reading ability, and mathematical ability. Intercorrelations among all the tests were calculated separately for each group.

The statistical design was a randomized complete blocks model, suitable for the determination of components of variance. The thesis presents the com-

plete procedures for determining the components, together with their standard errors of estimate, fiducial limits, and confidence intervals.

Conclusions

1. Both the textbook-centered and the laboratory-centered approaches as used in the research were effective methods of learning introductory high school chemistry.

2. With accelerated pupils, both methods are capable of producing significant increase of variance from initial status to final status. However the laboratory-centered method is capable of producing greater variation.

3. With non-accelerated pupils, the textbook method does not increase variation, while the laboratory method does so significantly.

4. The selection of experimental subjects by means of the randomization process described in the thesis is an effective means of matching groups simultaneously in mental ability, reading ability, mathematical ability, and age.

5. Estimates of the components of variance may be determined by the process described in the thesis. The standard error of estimate, fiducial limits, and the confidence interval of a component may also be computed by use of the formulas presented.

Microfilm copy of complete manuscript of 245 pages, \$3.06. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-716.

THE RELATIONSHIP OF READING ABILITY TO THE NEWSPAPER READING DONE BY ADOLESCENTS

(Publication No. 7270)

Helen Lucille Wardeberg, Ph.D.
University of Minnesota, 1953

The purpose of this study was to find whether any relationship exists between the reading ability of adolescents and the amount, difficulty and type of newspaper reading they do.

Trained interviewers using a stratified quota sampling method obtained readership data for 304 junior and senior high school students in Minneapolis.

Readership reports of the specific articles seen and read were obtained for the Minneapolis Morning Tribune and the Minneapolis (afternoon) Star in October, 1950. The Dale Chall Formula for Predicting Readability was used as a measure of the relative reading difficulty of the articles. Average difficulty, range of difficulty and article of highest difficulty read were computed for each respondent. Articles were classified into seven categories or types of news. Selected parts of the SRA Reading Record were used to obtain a measure of reading ability; selected parts of the California Tests of Mental Maturity were used for a measure of mental maturity.

Respondents were classified as good and poor readers on the basis of the reading test. The upper third of the group was compared with the lower third on the various factors of newspaper reading. The analysis of variance technique was used to analyze the variations in number and difficulty of articles read by good and poor readers. Also the effects of controlling chronological age and mental maturity were determined. The significance of difference between percentages was used to compare the groups to determine in which categories the good and poor readers read more articles and whether the pattern of reading differed for good and poor readers.

The major results showed that good readers both saw and read more articles than did the poor readers. When chronological age and mental maturity were controlled, there was still a significant difference in the number of articles read. With one exception, there was no statistically significant difference between good and poor readers on the three different ways of measuring difficulty of articles read. This exception was for average difficulty of articles in the Star. For several other measures the two groups differed though the significance of the difference was in the region of doubt. There was a significant difference between good and poor readers as to types of articles read. Good readers did a greater proportion of their reading in the Human Interest, Sports, and Editorials categories. Poor readers did a greater proportion of their total reading in the World News and Comics categories.

Microfilm copy of complete manuscript of 137 pages, \$1.71. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-717.

ENGINEERING

ENGINEERING, GENERAL

A STUDY OF ELECTROMAGNETIC FLOWMETER DESIGN AND OPERATION

(Publication No. 7521)

James Hayden Fisher, Ph.D.
Purdue University, 1954

An investigation was conducted concerning the design and operation of electromagnetic flowmeters. Three flowmeters were constructed employing single phase alternating magnetic fields, and two more were constructed employing polyphase field structures. The polyphase flowmeters were of a new type, not heretofore reported in the literature.

A series of tests were run with a single phase flowmeter employing solutions of distilled water and nitric acid as the test liquid. The experimental performance of the flowmeter was compared with the performance predicted by theory and found to drop with increased acidity of the test liquid in a manner not predicted by current theory. The best performance was obtained utilizing singly distilled water as a test liquid and the experimental results for that case coincided with theory. Poorest performance was obtained with a test liquid comprised of singly distilled water plus 1.1% by volume of White Fuming Nitric Acid; the performance being reduced to 60% of theoretical.

The two polyphase flowmeters were not similarly constructed and one design failed to operate while the other design was successful. The successful design was tested with constant flow and with flow transients of one or two seconds duration. The meter was found to give a D.C. flow signal while employing three magnetic fields energized from a conventional three phase A.C. voltage supply. The D.C. flow signal was predicted by the theory of the polyphase flowmeter and it was established that the polyphase flowmeter offers some advantages of both the single phase A.C. flowmeter and the D.C. flowmeter, yet avoids many of their disadvantages.

A design procedure was established in the course of constructing the five flowmeters. Design curves and equations are presented in discussing the aforementioned design procedure.

Microfilm copy of complete manuscript of 211 pages, \$2.64. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-718.

ENGINEERING, AERONAUTICAL

ANALYSIS OF LANDING GEAR IMPACT INCLUDING THE EFFECTS OF WHEEL SPINUP

(Publication No. 7490)

Charles William Coale, Ph.D.
Stanford University, 1954

A mathematical investigation is conducted into the operation of the airplane landing gear during the landing impact. Two types of oleo shock strut are considered and the differential equations governing their action are derived.

In the first half of the dissertation the effects of horizontal forces acting on the landing gear are neglected. The set of differential equations for vertical motion of the landing gear is derived. It consists of two linear equations and the nonlinear shock strut equation.

Methods of solving these equations are discussed. First a design method is presented for producing a desired force-time curve under one set of impact conditions. Next the application of numerical integration methods for solving the equations is outlined. The Modified Euler and Milne's methods are utilized. Finally an analytical method of solution is presented. In this method time series solutions are found over successive portions of the impact.

In the second half of the dissertation the set of landing gear equations is extended to include the effects of horizontal forces. These forces are produced by friction between the wheel and the ground during and after wheel spinup. The inertia forces of the landing gear vibrating as a cantilever beam are also brought into play.

Wheel spinup is first studied by means of a simple model. It is composed of a wheel restrained by a horizontal spring. A known vertical force $F(t)$ is applied to the wheel which is then placed on a moving surface. The resulting motion is investigated. General equations for this motion are set up and applied to the cases of linear and sinusoidal vertical forces.

The modified set of landing gear equations is then derived. It consists of three linear differential equations plus one nonlinear equation. Three separate phases must be considered: Phase One, during which the shock strut is inoperative due to the pre-stress pressure in the strut; Phase Two, with the shock strut operating and during which wheel spinup is completed; Phase Three, covering the motion after transition of the wheel to rolling, during which springback vibrations occur. The solution of the differential equations is investigated by the numerical and analytical methods applied previously.

Examples are presented throughout the dissertation to illustrate the methods developed.

Microfilm copy of complete manuscript of 147 pages, \$1.84. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-719.

ON THE AERODYNAMICS OF WINGS AT TRANSONIC SPEEDS

(Publication No. 7511)

John Robert Spreiter, Ph.D.
Stanford University, 1954

The transonic aerodynamic characteristics of thin wings are discussed from the point of view of a unified small disturbance theory for subsonic, transonic, and supersonic flow. Critical examination is made of the merits of the various statements of the equations for transonic flow that have been proposed in the recent literature. It is found that one of the less widely used of these possesses considerable advantages, not only from the point of view of a priori theoretical considerations, but also of actual comparison of theoretical and experimental results. The similarity rules for the forces and moments on wings of finite span are derived, the known solutions of transonic-flow theory are reviewed, and the asymptotic behavior of the lift, drag, and pitching-moment characteristics of wings of large and small aspect ratio is discussed. It is shown that certain methods of data presentation are superior for the effective display of these characteristics.

Theoretical pressure distributions on nonlifting circular-arc airfoils in flows with high subsonic free-stream velocity are found by determining approximate solutions of an integral equation derived directly from the differential equations for transonic flow. This method of analysis possesses the advantage of remaining in the physical, rather than the hodograph, variables and can be applied to airfoils having curved surfaces. Solutions are obtained using an iteration process which differs from the classical methods in that the quadratic nature of the integral equation is recognized. After discussion of the derivation of the integral equation and qualitative aspects of the solution, results of calculations carried out for circular-arc airfoils in flows with free-stream Mach numbers up to unity are described. These results indicate most of the principal phenomena observed in experimental studies. At subcritical Mach numbers, the pressure distribution is symmetrical about the midchord position and the drag is zero. The magnitude of the pressure coefficient is found to increase more rapidly with increasing Mach number than the first-order Prandtl-Glauert rule would indicate. If the iteration calculations are started using the linear-theory solution, it is shown that the retention of the quadratic feature has the interesting effect of forbidding shock-free supercritical second-order solutions. In order to obtain solutions for supercritical Mach numbers, it is necessary to start the iteration calculations with a velocity or pressure

distribution which contains a compression shock. When this is done, it is found that the iteration procedure converges to a definite result. The solutions indicate that the shock wave becomes of greater intensity and moves rearward across the chord with increasing Mach number, thereby producing a rapid increase in the magnitude of the drag coefficient. At Mach numbers close to unity, the variation of the pressure, local Mach number, and drag conforms, within the limitations of transonic small disturbance theory, to the known trends associated with the Mach number freeze. Some comparisons with experimental results are also included.

Microfilm copy of complete manuscript of 194 pages, \$2.43. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-720.

ENGINEERING, AGRICULTURAL

ELECTRIC AND INERTIAL FORCES IN PESTICIDE APPLICATION

(Publication No. 7156)

Henry Dittimus Bowen, Ph.D.
Michigan State College, 1953

The author presents the problems involved in work dealing with the deposition of small particles on plant surfaces. It is stated that the low recovery efficiency resulting from the use of current dusting and spraying machinery cannot be improved substantially without further information regarding the nature of the forces active in particle deposition. A theoretical approach is considered to be desirable because present evaluation techniques are considered inadequate to provide meaningful data in the light of the many physical phenomena that may effect both deposition and sticking after the particle strikes the surface.

The author proposes to obtain the order of magnitude of forces active in particle deposition and specifically the relation between electric and inertial forces that may be active within the plant regions. It is believed that this quantifying of the magnitudes of the forces will then allow the development of a greater understanding of the deposition and adherence problems. Also the theoretical results will allow more pointed investigations to be set up for the testing of ideas relative to improving machinery and techniques for particle deposition.

Instruments now available for measuring electric fields or potentials have relatively large capacitances and inertias associated with them. The volume distributions of charge that results when charged dust is blown into the inner regions of a plant contains such a small amount of charge and the distributions change so rapidly that present day instruments disturb the fields being measured greatly, and are not able to follow the rapid changes of the field.

Because of the above situation, a measureable field was calculated by two methods and also measured. The correlation being very good, it was concluded that calculation methods and assumptions used could be considered valid for calculations of those fields that could not be measured. A method of calculating the force produced on charged particles near small conducting disks at zero potential (approximating plant leaves) is given.

A study is made of the inertial forces produced and the resulting path of an uncharged particle that is described when an airstream carrying the particle is deflected by a surface.

A comparison is made between inertia, electric, and gravity forces for several electric fields. The results indicate that electric forces are generally small compared to inertia forces and are comparable in magnitude to gravity forces for uniform charge distributions. However, under actual conditions the forces may be considerably greater than calculated due to redistribution of charges in the cloud so that the charge density is no longer uniform.

The above results have shown that the electric forces developed within a plant region depend both on the charge density and the thickness of the cloud blanket near the depositing surface. This explains partially the inability of workers to transfer laboratory work on single surfaces and spheres with thick blankets of cloud surrounding them to the field where there exists much closer spacing of deposit surfaces with resultant thinner cloud blankets and thus lower forces.

Microfilm copy of complete manuscript of 152 pages, \$1.90. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-721.

ENGINEERING, CHEMICAL

GASIFICATION OF WASHINGTON COAL

(Publication No. 7189)

Louis Martin Dvoracek, Ph.D.
University of Washington, 1953

The State of Washington has large reserves of low grade subbituminous coal estimated at 52,000,000,000 tons. Gasification is one process for utilizing these reserves. The gas obtained by gasification could be converted into synthetic liquid fuels.

A three-unit fluidized pilot plant was constructed and placed into operation. The pilot plant consists of three concentric units constructed from stainless steel. The outside unit is the coker, next the burner, and the center is the gasifier. Oils and tar are recovered from the coking unit. The capacity of the pilot plant is about 25 pounds per hour.

Coal is transferred from the coker to the burner through holes located in the bottom of the burner wall. Transfer of hot coke from burner through holes

at the top and bottom of the gasifier wall supply the heat required in the center gasifier unit. The transfer of coal or coke in this fluidized bed system is a function of the diameter, number, and spacing of the holes.

Preliminary studies of coal obtained from Tono, Washington, in this unit indicate that ratios up to 3 to 1 of hydrogen to carbon monoxide can be obtained. A high carbon efficiency of 85 percent was also found. The amount of carbon monoxide and hydrogen produced was calculated to be 20 cubic feet per pound of dry ash-free coal. Also, a high thermal efficiency of 85 percent and a high ash content of 32 percent was recorded in pilot plant operations.

Several operating difficulties were observed during this pilot plant study. High oxygen and steam consumptions were noted. Clinkering of coal in the burner unit caused by the fusing of hot coke particles in collision limited the temperature of operation. Gas dilution and mixing was noted between units. Suggested improvements of preheating and elimination of flow restrictions should improve the general overall performance of the pilot plant.

Although, further studies are necessary to investigate all the variables, these preliminary results indicate that Washington low grade coal could be converted to synthesis gas with a high efficiency for the manufacture of liquid synthetic fuels.

Microfilm copy of complete manuscript of 76 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-722.

A STUDY OF HEAT TRANSFER TO LIQUID-SOLID SUSPENSIONS IN TURBULENT FLOW IN PIPES

(Publication No. 7196)

Aven Patterson Miller, Jr., Ph.D.
University of Washington, 1953

A study of the heat transfer coefficients of liquid-solid suspensions in turbulent flow in pipes has been made.

The experimental equipment consisted primarily of an 8 foot horizontal, steam to liquid, double pipe heat exchanger with the necessary auxiliary equipment for measuring stream flow rates and temperatures. The actual heating surface was a 1 inch copper pipe. In order that the circumferential surface temperature distribution might be measured, thermocouples were installed in the surface of the copper pipe and means provided for rotating the pipe. Heat transfer data were obtained for pure water, water-graphite suspensions of varying concentrations of solid, pure kerosene, and a kerosene-graphite suspension.

The water-graphite suspension of 5.8 percent concentration of solids by weight and the 4.7 percent kerosene-graphite suspension were Newtonian fluids as indicated by shear-stress diagrams obtained from measurements with a modified MacMichael rotational

viscometer. The more concentrated water-graphite suspensions of 9.97 and 13.5 percent solids were pseudoplastic with the apparent viscosity in turbulent flow being the limiting viscosity at infinite shear.

A comparison of the water film heat transfer coefficients obtained from the surface thermocouple temperature data with those obtained from Wilson plots indicated that coefficients obtained by the latter method would be correct within the limits of accuracy of most experiments. An approximate correction to the Wilson method to allow for a change in the steam film coefficients with a change in fluid velocity in the pipe may be made by assuming the coefficient to vary in a manner predicted by the Nusselt Equation.

The data for the various suspensions may be correlated at a constant Reynolds number on a plot of the Prandtl group versus the Nusselt group. The correlation is achieved by evaluating the physical properties of the fluid at the average bulk temperature in the following manner: 1) the viscosity is the apparent viscosity of the suspension in turbulent flow obtained from pressure drop correlations or measured with a rotational viscometer, 2) the density is that of the suspension, 3) the specific heat is that determined directly or calculated on the basis of the specific heat of the suspending medium and solid being additive (by weight), and 4) the thermal conductivity is that of the suspending medium.

No correlation is achieved if the thermal conductivity used in the above correlation is determined from averages, either by volume or weight percent. This fact indicates that for suspensions where the thermal conductivity of the solid particles is greater than that of the suspending medium, the controlling resistance to heat transfer is in the medium and the thermal conductivity of the solid does not appreciably affect the heat transfer. The data for this investigation and the available data on heat transfer of suspensions in the literature may be represented within ± 15 percent by the following equation:

$$\frac{hD}{k} = 0.029 \left(\frac{DG}{\mu} \right)^{0.8} \left(\frac{C_p \mu}{k} \right)^{0.4}$$

where the physical properties have been evaluated in the manner given above.

Microfilm copy of complete manuscript of 104 pages, \$1.30. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-723.

THE EFFICIENCY OF A DROPLET REFLUX RECTIFICATION COLUMN

(Publication No. 7504)

Sanford Milton Roberts, Ph.D.
Stanford University, 1954

The object of the thesis is to describe the design, construction, and operation of a droplet reflux rectification column with particular reference to the separation efficiency of the process.

In contrast to common rectification columns where vapor-liquid contact is achieved by the mixing of liquid and vapor on plates or on packing material, this process showers reflux as drops from the spray head through a void column (3.875-inches inside diameter and 4 feet long). The transfer of the components is aided by the intimate mixing of the falling drops with the rising turbulent vapors.

The efficiency of separation was expressed in terms of the $(NTU)_{OG}$ (the number of over-all transfer units expressed in terms of the gas phase driving force). The apparent and the corrected $(NTU)_{OG}$ showed a maximum with vapor rate, which ranged from 884 to 4670 lbs/hr ft². The maximum occurred for both the benzene-carbon tetrachloride system and the methanol-water system employing spray heads with .0135-inch diameter drill holes and .008-inch diameter drill holes respectively. The apparent $(NTU)_{OG}$ included the mass transfer due to both the droplets and the associated wetted wall liquid. The total wetted wall liquid rate amounted up to 90 per cent of the spray head rate. The corrected $(NTU)_{OG}$ was obtained from the apparent $(NTU)_{OG}$ which was adjusted for the condition of no drops striking the wall. The corrected $(NTU)_{OG}$ for the shower head with the .008-inch diameter holes was in the range of 1.0 to 1.8. This is about one-half the $(NTU)_{OG}$ reported in the literature for packed distillation columns of comparable diameter.

The shape of the $(NTU)_{OG}$ vapor rate curve was best explained by the variation in the interfacial area for mass transfer. The increase of $(NTU)_{OG}$ with initial increase of vapor rate was in agreement with the literature on spray towers. The subsequent decrease in the $(NTU)_{OG}$ as the vapor rate was further increased was best explained by calculations showing that a large number of small drops were carried out of the column at the higher vapor rates.

For the benzene-carbon tetrachloride system the apparent $(NTU)_{OG}$ using the shower head with the .008-inch diameter holes was about twice the apparent $(NTU)_{OG}$ using the shower head with the .0135-inch diameter holes. The corrected $(NTU)_{OG}$ was about three times larger. The apparent $(NTU)_{OG}$ for the benzene-carbon tetrachloride system using the shower head with the .008-inch diameter holes decreased as the reflux ratio decreased.

The $(NTU)_{OG}$, corrected and apparent, for the methanol-water system were approximately 10 per cent larger than for the benzene-carbon tetrachloride system at the same vapor rates.

In the droplet reflux rectification the gas film resistance was the controlling resistance. Gas film resistance was also the controlling resistance in the wetted wall rectification runs.

Microfilm copy of complete manuscript of 141 pages, \$1.76. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-724.

ENGINEERING, ELECTRICAL

RESONANCE PHENOMENA IN TIME-VARYING CIRCUITS

(Publication No. 7495)

Mariano Campanero Herrero, Ph.D.
Stanford University, 1954

This dissertation comprises a study of the sweeping-filter problem and its applications to a panoramic receiver. A panoramic receiver or spectrum analyzer may be defined as one that displays its response as a function of the frequency setting of the receiver. There are two general approaches to this problem: 1) sweep through all or part of the primary tuning range of a superheterodyne receiver by sweeping the local oscillator; 2) sweep the i-f or r-f pass band of the receiver (variable-tuning filter type).

It has long been known that certain limitations are imposed on the rapidity with which a tunable filter is swept over the band of frequencies to be observed, but no comprehensive study of this problem is available in the literature.

It is desired that the instantaneous center frequency of the filter shall have a periodic variation with time. This result may be accomplished with several combinations of variation of the parameters. The case of a variable inductance in a parallel R-L-C filter is studied in some detail, since it is the simplest mathematically. Variation of the capacitance, or of more than one element, leads to equations more difficult to solve. These cases are studied less thoroughly, although certain results can be extrapolated to these cases from the variable-L study.

As with constant-element systems, solution by direct attack on the differential equations is tedious and gives more information than is desired. The steady state behavior, after the receiver has been turned on long enough for all transients to have disappeared, is of primary interest. More than this, it is only the envelope of this response which is desired, since it is only the detected envelope which appears on the indicator oscilloscope face. Thus, a more sophisticated approach is advantageous.

A system transfer function is defined as the ratio of amplifier output to input when both are varying exponentially with time. This is similar to the amplifier gain or transfer function in the constant-element case, except that since the system elements are varying it is a function of time as well as the frequency variable. This transfer function for a particular value of frequency and as a function of time, may be interpreted as the envelope of the output with a sinusoidal input of the chosen frequency. Thus, solution for this transfer function yields the desired information directly.

The conditions for a quasi-steady state to hold are determined. A combination of parameters whose value must be small in comparison to unity is indicated in every case. The influence on the solution of several parameters is studied. Other cases of similar center-frequency variation are compared with the inductance-varying case.

A comparison is made between the sweeping filter case and the so-called "gliding-tone problem" in panoramic receivers of the sweeping-local-oscillator type. Both cases are similar in quasi-steady state. The behavior of the system output with increasing sweeping frequency in the gliding-tone problem is such that the peak of the solution decreases with increasing sweeping frequency and instability cannot occur, whereas in the sweeping filter the peak magnitude is almost constant and under appropriate conditions, instability may appear.

Several experimental results in the backward-wave amplifier used as a sweeping filter at frequencies of 2000 Mc/s are included. From them, the similarities between the three cases are investigated. A table is included that indicates the analogies and differences.

Various types of parametric excitation are compared and physical interpretation of the behavior is presented, as well as the differences in the mathematical behavior of the system differential equations.

Microfilm copy of complete manuscript of 110 pages, \$1.38. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-725.

ENGINEERING, MECHANICAL

TEMPERATURE GRADIENTS IN THE BOUNDARY LAYER WITH HEAT TRANSFER

(Publication No. 5457)

Louis Edward Bothell, Ph.D.
State University of Iowa, 1953

The phenomenon investigated in this dissertation is the effect of the mechanical surface condition and the initial turbulence level upon the characteristic shape of the temperature profile in the turbulent boundary layer. In particular the case of a heated flat plate oriented parallel to the direction of the air stream is considered.

The purpose of this investigation was to establish the characteristic shape of the temperature profile as the magnitude of the surface roughness approached the depth of the laminar sublayer. Two levels of initial turbulence were used in the course of the investigation.

In the turbulent boundary layer two quantities were measured; the temperature distribution normal to the panel, and the dynamic pressure from which was obtained the velocity distribution. The local temperatures of the heated panel and the free stream temperature were measured.

An equation was developed which related the local boundary temperature to the local boundary layer velocity. The experimental investigation proved the theory to be correct for low Mach Numbers.

The velocity profile was found to be a logarithmic function of the distance from the plate.

The shape of the temperature profile was not effected by the plate surface roughness used in this investigation. The initial free stream turbulence levels changed the characteristic shape of the temperature profile to a marked degree. For the higher free stream turbulence levels the slope of the temperature in the turbulent portion of the boundary layer decreased.

For each initial turbulence level and temperature ratio the velocity profiles for the various surface conditions formed a family of curves which had a common solution near the laminar sublayer.

Microfilm copy of complete manuscript of 96 pages, \$1.20. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-726.

A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF FACTORS INFLUENCING INSTRUMENT GEAR ACCURACY

(Publication No. 7241)

La Verne Frank Knappe, Ph.D.
University of Minnesota, 1953

This investigation is concerned with the development of methods for the analysis of problems encountered in the design of gears for instruments, mechanical computers, servo mechanisms, and automatic controllers. The commonly used graphical methods for the analysis of gear problems are useful to demonstrate the general principles of gearing but are not satisfactory for the problems that arise in precision gearing. This thesis presents a mathematical analysis of the effect of gear errors on the angular accuracy of gear trains. The exact methods of solutions to the problems are presented considering the common variations in the gear parameters. More useful approximate equations are also developed by making assumptions regarding the gear parameters. These equations have been simplified and put in such a form that they can be used in the design and manufacture of precision gear trains.

During the past decade the use of servo mechanisms, mechanical computers, precision instruments and automatic controllers have increased very rapidly. All of these mechanisms use gear trains in some form to transmit rotational motion or to position shafts. As these mechanisms become more refined the requirements on the gear train accuracy have become more stringent. The allowable backlash may be reduced to prevent "jitters" in servo mechanisms and to permit more accurate positioning of shafts that rotate in both directions. It is not uncommon today to find specifications in contracts which limits the angular error of some gear driven positioning mechanisms, the amount of backlash in a gear train or the error in some computation done by gearing. The problem facing the designer of these precision gears is not one of strength or wear but one of angular accuracy and backlash.

By the mathematical analysis of the effect of gear errors on the gear train accuracy developed in this thesis the gear designer can predict the angular error that will be present in a gear train and the manner in which it varies. He can also set up assembly procedures which will cut down the assembly time and the rate of rejections of the gear trains. It may also be possible for him to increase the tolerances on the gears and thereby also decrease the number of rejections at inspection. This would mean a saving of many thousands of dollars in most cases for a few hours of engineering time. Also the success or failure of a precision mechanism or instrument may depend largely on the ability of the gear trains to perform their required function.

Microfilm copy of complete manuscript of 137 pages, \$1.71. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-727.

IRREVERSIBLE THERMODYNAMICS OF VAPOR TRANSMISSION THROUGH POROUS MEDIA

(Publication No. 7251)

Raghunath Ganpatrao Mokadam, Ph.D.
University of Minnesota, 1953

A porous medium is considered to be composed of solid particles uniformly dispersed in space. A suitable thermodynamic model for a heterogeneous system, consisting of various fluid phases and the porous medium as a solid phase, is assumed by considering that the phases are thoroughly dispersed in the system. On the basis of this assumption, it has been possible to treat the system as effectively continuous. The bulk pressures and densities of the phases are defined and used in the equations of continuity of mass, momentum, energy and entropy of the system. Only gravity is considered as an external force acting on the system.

It is observed that the energy flow, motion of the center of mass of the system, diffusion flows and chemical reactions are the irreversible phenomena which cause entropy generation in the system. Because of the frictional resistances, the motion of the center of mass is an irreversible phenomenon.

Three phenomenological equations are derived to describe the energy flow, the motion of the center of mass of the system and the diffusion flows. These equations are based on the assumption that there is a linear relation between the flows and the forces, and that a coupling between the flows exists.

A linear phenomenological relationship between the reaction rates and the chemical affinities does not exist, unless the system is very close to chemical equilibrium.

The physical significance of the phenomenological equations is discussed in the text. The energy flow in the system is caused by conduction, convection due to frictional forces and the Dufour effect. The diffusion of one component in the system depends on

thermal gradients, frictional resistance and the diffusion of other components in the system. The motion of the center of mass of the system is dependent upon the temperature gradients, frictional resistance and the chemical potential gradients of all the components in the system.

The phenomenological relations are applied to describe vapor transmission in a system consisting of a perfect gaseous mixture of air and vapor in the gaseous phase, a single component adsorbed phase and the porous medium as a solid phase. It is observed that the driving forces in vapor transmission are the gradients of temperature, air pressure, vapor pressure, equilibrium adsorbed phase content and the relative pressure, and gravity.

It is shown that Fick's law does not take into account the effect of adsorption and thermal gradients on vapor transmission through porous adsorbents.

The generalized Darcy law is derived from the phenomenological relation describing the motion of the center of mass of the system. It is observed that the Darcy law cannot be applied satisfactorily to describe vapor transmission through porous adsorbents.

Tests to obtain pertinent data for the experimental verification of the vapor transmission equation are outlined in the text.

Microfilm copy of complete manuscript of 87 pages, \$1.09. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-728.

ENGINEERING MECHANICS

LARGE DEFLECTIONS OF CIRCULAR PLATES

(Publication No. 7496)

Roy Francis Hooley, Ph.D.
Stanford University, 1954

This dissertation presents a solution to the problem of a circular plate subject to large deflections due to a uniform load. The edges of the plate are simply supported and can suffer no radial displacements. It is assumed that the stress is below the proportional limit and that the curvatures can be expressed with sufficient accuracy by the well known simplified formulas. It was found possible to introduce a dimensionless notation which would transform all variables into a dimensionless form. In particular the dimensionless load q is

$$q = \frac{\bar{q}a^4}{Eh} [12(1-\mu^2)]^{3/2}$$

where \bar{q} is the load on the plate with radius a and thickness h . The modulus of elasticity and Poisson's ratio are E and μ respectively.

Three independent methods of solution are given for this particular example. The first method consists in expanding the deflection and stress function as infinite series in q . This method though does not

carry very far into the non-linear range as these series diverge for $q > 16$.

The second method consists in solving the large deflection equations by an iteration procedure. It is shown that the series of the first method can be built up by iteration if the initial input is the solution to the linear problem. Convergence is then obtained only where the solution for the large deflection problem is close to the linear case. In order to produce a convergent series for higher q the output from each iteration cycle is multiplied by a function of q before being used as the input for the next cycle. This function of q is arranged so that these input values are, on an average, the best possible. One cycle now gives a solution valid for $q < 40$ while two cycles give a solution valid for $q < 1000$.

The third method is based on the idea that for very large loads the deflection surfaces of a plate and a membrane are essentially the same. The plate problem is then solved by adding small corrections to the deflection and stress function of a membrane. For sufficiently large loads these corrections are small enough so that the differential equations governing them may be linearized. Their solution can then be expressed as a power series in the radius. It is then shown that if an approximation is made to this differential equation its solution can be expressed in closed form in terms of modified Bessel functions. For $q = 1000$ the second iteration cycle and the corrected membrane solution give almost identical results so that further iteration cycles are deemed unnecessary and this third method is taken as the solution for all higher q .

Although numerical examples of other loads and boundary conditions were not computed it can be said that the corrected membrane solution would be of use in all cases with edge constraints on the plate similar to the constraints on the example discussed here. The iteration method though would be of use for any boundary conditions or load.

This solution shows that as the load increases the position of the maximum bending moment moves away from the center of the plate. Because of this there is a range of load for which the maximum stress is not at the center. It was also found that for extremely large loads the corrections added to the membrane in order to solve the plate problem were felt only locally near the edge so that the stresses and deflections in the central portion of a membrane and plate were, to a high degree of accuracy, the same.

Microfilm copy of complete manuscript of 120 pages, \$1.50. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-729.

ELASTO-PLASTIC BENDING OF BEAMS ON ELASTIC FOUNDATIONS

(Publication No. 7506)

Paul Seide, Ph.D.
Stanford University, 1954

In many problems of the bending of perfectly plastic beams, the concepts of limit design permit the determination of the ultimate load without an analysis of the intermediate processes of elasto-plastic deformation. These concepts can be too conservative, however, when the beam material exhibits strain-hardening and, above all, do not apply for the class of problems in which the beam is supported on a continuous deformable foundation. This latter class of problems is the subject of the present investigation.

The differential equation associated with the engineering theory of elasto-plastic bending of beams on elastic foundations is non-linear and requires the use of approximate methods for its solution. A method of numerical integration is used in the present investigation of beam materials having a bi-linear stress-strain curve, since a practical method of application of variational principles has not as yet been developed for problems in which the elastic and plastic regions are distinct. A detailed solution of the bending under concentrated load of infinite beams of rectangular cross-section is obtained by this method for two values of the strain-hardening slope which approximate mild steel with no upper yield point and 24 ST aluminum. Charts and tables showing the variation of bending moments, shear forces, deflections, and slopes with load are presented.

Since methods of numerical integration of differential equations require an excessive amount of time and labor, an approximate method of analysis is developed whereby the non-linear moment-curvature diagram is replaced by two straight lines. The investigation of approximate methods reveals that for any particular problem the results for beams of various cross-sectional shapes should be practically identical if the fully plastic moment is used in the appropriate non-dimensional parameters rather than the yield moment. The results of the approximate theory for the bending of an infinite beam by a concentrated load are in very good agreement with those obtained by the more accurate numerical integration method, and require far less time and effort so long as only one plastic region exists in the beam. An investigation of finite beams indicates that the infinite beam results are adequate for beams whose effective length is greater than π , as is also the case for elastic beams.

The theoretical results are compared with available experimental results and fair agreement is indicated. There is a consistent 5 percent error between theory and experiment in both the elastic and upper plastic regions which appears to be attributable only to inaccuracies inherent in the engineering theory of bending of beams. The error is somewhat greater in the vicinity of the yield load, but this is to be expected since the assumed moment-curvature diagram is a poor approximation in this region.

Microfilm copy of complete manuscript of 160 pages, \$2.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-730.

DISPLACEMENT AND STRESS DISCONTINUITIES IN RINGS, CYLINDERS, AND CONES

(Publication No. 7516)

James Cammack Wilhoit, Jr., Ph.D.
Stanford University, 1954

The problem of displacement discontinuities in multiply connected elastic bodies has been given considerable attention by elasticians, plasticians, and mathematicians since V. Volterra (1) formulated the problem in detail in 1907. Volterra stated and proved the fundamental theorem of elastic dislocations (the term "dislocation" is due to Love (2)). It states that if the strain in an elastic body is continuous, the only possible discontinuous displacement, at any surface of discontinuity within the body, is such that the displacement of the material immediately on one side of the cut, relative to that immediately on the other side, is a rigid body displacement. Applied to the thin ring (that is, a washer), the three dislocations of plane stress have been of considerable practical importance in the bending of a portion of a circular beam (see, for instance, Timoshenko and Goodier(3) and Goodier and Wilhoit(4)). The other three Volterra dislocations for a thin ring, involving thin plate theory, are of practical value in the problem of the bending of a portion of a thin ring out of its plane of curvature. These were not found in the literature. Complete formulations of these six Volterra dislocations for a thin ring are given, and applications indicated.

It is well known that the Airy stress function ϕ can be represented by

$$\phi = \text{Re} \left[\bar{z} \psi(z) + X(z) \right]$$

where $\psi(z)$ and $X(z)$ are analytic functions of the complex variable $z = x + iy$. Volterra dislocations are essentially obtained from the function $(\log z)$. The second problem of this thesis was to obtain the fundamental states involving discontinuities in stress (as well as in displacement) and these were found to arise naturally from $(\log z)^2$. Further it is noted that, in thin plate theory, if the plate is free of lateral load q , the deflection w can be represented by

$$w = \text{Re} \left[\bar{z} \psi(z) + X(z) \right]$$

and again, if $\psi(z)$ and $X(z)$ contain $(\log z)^2$, the resulting moments and forces per unit length are discontinuous. The second problem of this dissertation formulates the six fundamental "stress" dislocations (involving discontinuous force or moment across the cut) in thin rings and their solutions, and indicates their application. A specific example, the

bending of a thin ring with a radial cut, supported on one side of the cut, free on the other, is solved using these "stress" dislocations.

The extension of the three Volterra dislocations and the three "stress" dislocations of plane stress to plane strain is immediate. The other three Volterra dislocations for cylinders (not cases of plane strain) are available in the literature, and one of them, that involving a discontinuous displacement in the axial direction, is used later in the solution of the special problems mentioned below. The "stress" dislocations for cylinders are incomplete since no analog to those obtained from thin plate (flexure) theory for thin rings was obtained.

Finally certain related problems involving Volterra dislocations are discussed. Solutions are given for a hollow cone and for a hollow sphere with a plane radial cut, one face of the cut being displaced axially with respect to the other. Some aspects of dynamic dislocations in circular cylinders are discussed but the results are largely negative. Elastic Volterra dislocations have application to thermal stress in rings and cylinders. When the elastic limit is exceeded, an elastic-plastic dislocation is required. A solution of this type for a ring or cylinder uniformly hot inside, cold outside, is worked out for a non-strain hardening material.

BIBLIOGRAPHY

1. V. Volterra, "Sur l'équilibre des corps elastiques multiplément connexes," *Annales Scientifiques de l'Ecole Normale Supérieure*, Series 3, Vol. 24 (1907), p. 401.
2. A. E. H. Love, *A Treatise on the Mathematical Theory of Elasticity*, American Edition, New York: Dover, 1944, p. 221.
3. S. Timoshenko and J. N. Goodier, *Theory of Elasticity*, New York: McGraw-Hill, 1940.
4. J. N. Goodier and J. C. Wilhoit, Jr., "Concentrated Radial Loads on Thin Curved Beams," Accepted 1953 for publication in *Journal of Applied Mechanics*.

Microfilm copy of complete manuscript of 139 pages, \$1.74. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-731.

ENGINEERING, MINING

DRY CONTROL OF DUST FORMED DURING PERCUSSION DRILLING

(Publication No. 7231)

Howard Levi Hartman, Ph.D.
University of Minnesota, 1953

A theoretical analysis confirmed by experimental work was conducted on the formation, ejection, cap-

ture, and transport of cuttings during dry percussion drilling. The exhaust system proposed for dust control and cuttings removal employed a hood, hose, separator, and suction source — only the first two components being included in this analysis.

From a study of the cutting action of a drill bit and the similarity to a crushing process, a theory of percussion drilling was proposed based on Rittenger's energy law of comminution. The theory states that the concentration of dust formed is proportional to the energy available for drilling raised to the 3.3 power for a constant speed, to the first power for a constant cuttings size, and to a power between 1 and 3.3 if both size and speed vary. If the energy output of the drill E , drilling speed S , and particle size d are known, the dust concentration N when drilling a given rock under varying conditions may be computed as follows:

$$N_2 = N_1 \frac{E_2}{E_1} \frac{S_2}{S_1} \frac{d_1^{3.3}}{d_2^{3.3}}$$

Factors which may produce changes in the above quantities are drill size, air pressure, steel size and length, thrust, and bit gage, wear, number of wings, hardness, cuttings clearance, flushing holes, and rotation.

Ejection of cuttings from the drill hole is accomplished by dynamic projection and air dispersion. The former process is most effective in removing large particles (over 50 microns). When free of the hole, the coarse particles are projected at velocities up to 35 fps (for a J40 jackhammer) in arching trajectories. These paths were calculated and filmed by high-speed motion-picture photography. The fines are ejected with a swirling motion at velocities of 10 to 50 fps (varying with drill size and bit gage) and, as dust clouds, are buffeted by dispersion air currents. Ejection is affected by location of bit flushing holes, size of air tube, location of exhaust ports, diffusion and confinement of working place, and size, depth, and angle of hole.

An exhaust hood fitted over the steel and covering the mouth of the drill hole captures the coarse cuttings by destroying their kinetic energy and the fines by diverting airflow into an exhaust hose. The critical capture velocity of hood airflow is 9 to 12 fps, which is much less than the cuttings ejection velocity, the supposed minimum. An experimental hood of an improved shaped design provided superior dust control at low airflows (40 to 80 cfm) and permitted somewhat faster drill speeds over other hoods tested. Dry drilling with an exhaust system proved as effective as wet drilling for dust control and attained faster speeds.

The minimum velocity of hose airflow required for pneumatic conveying of drill cuttings is dependent on particle size and specific gravity and load density (weight of solids per cubic foot of air). In drilling granite, the critical velocity is 24 fps at 0 load density and 15 fps at 935 gr/cu ft for horizontal transport. For vertical conveying, the minimum velocity is 21 fps at 500 gr/cu ft, less than the calculated terminal velocity. Pressure drops vary mainly with

load density and inclination in a non-linear version of the Fanning friction formula but are also affected by air velocity, pipe size, and particle size.

Based on the above findings, a dry drilling control system is proposed. Using a shaped hood similar to the experimental model and having a face diameter of 3-1/2 in., an exhaust flow of 50 cfm

provides a face velocity of 13.6 fps. The hood is held in place by a spring and arm arrangement for high-angle drilling. With a 2-in. exhaust hose, the air conveying velocity is 37.7 fps.

Microfilm copy of complete manuscript of 214 pages, \$2.68. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-732.

GEOGRAPHY

GLACIAL DEPOSITS OF THE YORKVILLE, ILLINOIS, QUADRANGLE

(Publication No. 7062)

Robert Dean Rudd, Ph.D.
Northwestern University, 1953

The Yorkville Quadrangle of the United States Geological Survey is a rectangular area of approximately 220 square miles, the northeast corner of which is some thirty-five miles west-southwest of the Loop in Chicago. This paper is primarily a study of the glacial deposits and landforms of this quadrangle.

The major features of the geography of the quadrangle are presented, including landforms, climate, natural vegetation and soils, drainage, population, economy, and transportation facilities. Of primary concern, however, are the landforms; since they are predominantly glacial in origin a summary of continental glaciation prefaces their detailed discussion. Included in the summary are the broad features of the theory of glaciation, the formation of glacial landforms, and glaciation in northern Illinois.

The several glacial landform types present in the quadrangle have been mapped and described with respect to their topographic expression, constituent materials, and mode of formation. They were formed during the Tazewell and Cary substages of the Wisconsin glacial stage. During the Tazewell substage the Farm Ridge ground moraine was deposited and it constitutes the oldest surface deposit present. Underlying Farm Ridge till, earlier deposits of Bloomington till are locally visible but do not constitute surface deposits. The retreat of the Farm Ridge ice was followed by the advance of Marseilles ice which formed an outer end moraine and ground moraine and an outwash plain; then, after a short retreat, an inner end and ground moraine. The Marseilles inner end moraine is one of the most prominent in the state, and a portion of it extends across this quadrangle to near the east edge where the younger Minooka end moraine overrides it at right angles. The final retreat of the Marseilles ice was accompanied by the formation of glacial Lake Lisbon with meltwater being trapped between the large end moraine and the retreating ice. During the Cary substage the ice readvanced to form a series of end moraines, the first of which was the Minooka

moraine. The orientation of the Cary end moraines, such as the Minooka, contrasts considerably with that of the Tazewell end moraines indicating the significant time break between the two substages. Nowhere is the contrast in orientation better shown than at the point where the Inner Marseilles and the Minooka end moraines meet in this quadrangle. It seems possible that the Minooka advance came farther west than indicated by the Minooka end moraine and then retreated to form that moraine during a more extended ice stand. Outwash and ground moraine were also deposited during the Minooka glaciation. The later Valparaiso glaciation affected the quadrangle considerably through the great quantities of meltwater released. West Chicago gravels covering a large part of the north one-half of the quadrangle were emplaced, and flood waters of the Kankakee Torrent created Lake Wauponsee which occupied a considerable area in the south one-half.

The landforms of this quadrangle have been correlated with those in the surrounding areas. The areal relationships of the several landforms, their shapes, and the nature of their materials are utilized in a discussion of the physiographic history of the quadrangle. This history is interrelated with the important events which affected surrounding areas. The age, description, and structure of the bedrock surface are also examined briefly. A comparison of the topography of that surface and the surface of the glacial deposits reveals considerable difference between the two and very little control by the bedrock surface. The highest and lowest elevations of the two surfaces are not located coincidentally, and present streams cross hills and valleys of the underlying surface indiscriminately.

Microfilm copy of complete manuscript of 224 pages, \$2.80. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-733.

GEOLOGY

THE PETROLOGY AND STRUCTURE OF THE PALAU VOLCANIC ISLANDS

(Publication No. 7278)

Gilbert Corwin, Ph.D.
University of Minnesota, 1952

The Palau Islands, between latitudes $6^{\circ} 50' N$ and $8^{\circ} 30' N$ and longitudes $134^{\circ} 5' E$ and $134^{\circ} 45' E$, are situated on the crest of one of the large arcuate ridges which are conspicuous features of the Western Pacific Ocean. There are two sharply contrasting types of islands. In the northern half of the area the islands are composed of volcanic rocks, and of these Babelthuap Island is the largest and accounts for three-fourths of the entire land surface. In the southern part are numerous limestone islands, among which are Peleliu and Angaur. Near the center of the group are islands, such as Koror, composed in part of volcanics and in part of limestone and displaying the characteristics of both island types. Most of the Palau Group, including all the volcanic islands, is enclosed by a large barrier reef.

Three volcanic formations composed principally of pyroclastic rocks and six younger sedimentary units have been defined and mapped. The oldest exposed rocks are the Babelthuap formation which is succeeded by the Aimeliik. Both of these formations are composed largely of basaltic fragmental material that was erupted in the Eocene. The overlying Ngeremlengui formation is composed of dacitic, andesitic, and minor basaltic fragmental material that probably was erupted in the Oligocene. Numerous dikes, sills, and plugs were intruded into the volcanic formations. The sedimentary units range in age from Miocene to Recent and include raised estuarine clay, silt, and lignite (Airai clay), raised limestone (Palau limestone), raised terrace and beach deposits, and the present alluvium, mangrove swamp deposits, and reef rock.

The volcanic activity in the Palau Islands appears to be related to the tectonic development of the underlying arcuate ridge as is indicated by the distribution of the formations and by the fault pattern. The principal eruptive center probably was in the western part of Babelthuap Island in the vicinity of Karamado Bay.

The present landforms are largely the result of structural modification of the original volcanic topography and of generally deep weathering and rapid erosion under humid tropical conditions. The weathering has produced laterite, and bauxite was at one time mined and concentrated on Babelthuap for shipment to Japan.

Erosion levels and the later sedimentary formations reflect a complex succession of emergence and submergences in the Pliocene and Pleistocene. Erosion levels have been recognized at 5 feet, 20-25

feet, and 215 feet. Others occur between and above these. At least two submergent levels can be recognized.

The Palau volcanic rocks range from olivine-augite basalts to silicic hornblende dacites. Hypersthene-augite basaltic andesite and augite-hypersthene andesite are the most abundant. Nine major mineral assemblages based largely on mafic phenocrysts and their relative abundance are recognized. Rock varieties which do not belong to these assemblages seem to be hybrid types.

Chemically, the Palau volcanic rocks are similar to other Circum-Pacific rocks and show characteristic differentiation trends. They are distinguished by their high lime and low potash contents, and by the high ratio of magnesia to total ferromagnesian oxides and low ratio of potash to total alkalis.

Microfilm copy of complete manuscript of 298 pages, \$3.73. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-734.

GEOCHEMICAL STUDY OF CHERT AND RELATED DEPOSITS

(Publication No. 7247)

John Alfred Maxwell, Ph.D.
University of Minnesota, 1953

Chemical analyses of 24 samples of high-silica sedimentary materials indicate remarkably similar bulk compositions. Twelve of the samples are chert; the remainder are novaculite, flint, siliceous oolite, silicified wood, melikaria, chalcedony nodule, and a silicified algal (?) deposit. The samples range from Precambrian to Quaternary and have a wide geographic distribution.

The samples were carefully selected to include only material that appeared homogeneous and fresh, and representative of a number of deposits for which different modes of origin have been proposed. The narrow range of silica, 95.00-99.95 percent, is a striking illustration of the facility of sedimentary differentiation to produce remarkably pure chemical types. Ranges for the minor constituents in weight percent follow: Al_2O_3 , 0.00-1.95; total iron as Fe_2O_3 , 0.04-0.90; MgO , 0.00-0.49; CaO , 0.00-1.54; Na_2O , 0.00-0.09; K_2O , 0.00-0.33; total water, 0.01-1.18; and CO_2 , 0.00-1.20. Quantitative averages for some minor and trace constituents in parts per million are P, 105; Ti, 96; Mn, 70; Li, 11; Mo, 2; As, 1; and Ge, 0.5. Average semi-quantitative estimates for trace elements are Ba, 23; Sr, 13; Sc, 4; Be, 0.3 and Ga, 0.2. The heavy metals Co, Cr, Cu, Ni, Sn, and V were not found in all samples, and the average for the group is 20 ppm. Bi, Pb and Zr were not detected in any of the samples.

The relatively small variations in major, minor and trace constituents of the 24 samples can be accounted for almost entirely by varying quantities of clay mineral, calcite, secondary iron oxide, dolomite, and traces of other minerals found in thin sections of the samples. There may be some diadochic substitution of As and Ge for Si, but generally the non-silica constituents can readily be assigned to one or more of these minerals.

Powder density and refractive index determinations show a variation with total water content. Some scattering of points in variation diagrams are attributed to impurities, notably of clay mineral, in chert samples. The Dover Chalk flint with a high total water content (0.95 percent) has a low density (2.599) and the presence of some opal is inferred. The samples range considerably in color; Fe_3O_4 is the red pigment of certain samples, and organic carbon is the dark-coloring agent of others. Textural differences are great but the samples may be divided into two groups, a fine-grained type termed cryptocrystalline, and a somewhat coarser-grained microcrystalline type. On this basis, chert may be differentiated from novaculite.

Compared to the average compositions of shale, sandstone and limestone, the siliceous deposits show

a characteristic enrichment in Li, Sc and Sr. On the average, chert (12 samples) is relatively impure compared to novaculite (5 samples). Analyses of novaculite (3 samples) from the Caballos formation of West Texas closely resemble analyses (2 samples) of novaculite from Arkansas. The average of 3 samples of chert from the Caballos formation, although containing smaller amounts of non-silica constituents than the previous average of 12 samples, nevertheless is in sharp contrast with the relatively pure Caballos novaculite. Different origins cannot logically be assigned to the interbedded Caballos cherts and novaculites, and the differences between them are essentially those between the cryptocrystalline and microcrystalline textural varieties. The physical conditions that control the grain size are not fully understood, but the conditions which permit development of coarser grain and crystallization of normal quartz appear also to be favorable for elimination of impurities, giving rise to remarkably pure deposits such as novaculite.

Microfilm copy of complete manuscript of 136 pages, \$1.70. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-735.

HEALTH SCIENCES

HEALTH SCIENCES, SURGERY

PATHOLOGY AND PATHOGENESIS OF REGIONAL ENTERITIS

(Publication No. 7289)

Ward N. Van Patter, Ph. D.
University of Minnesota, 1952

Three hundred and seventy-seven lesions removed at the Mayo Clinic from a total of 342 patients with regional enteritis were examined with particular emphasis on a detailed histopathologic study of the intestinal process. The characteristic gross findings include the predilection of the disease for the terminal portion of the small bowel, induration and edema of the intestine and its mesentery, enlargement of the regional lymph nodes and mucosal ulcerations along the mesenteric border. Abscess and fistula formation were frequent complications.

The microscopic pathologic findings can be divided into primary and secondary processes. The primary process includes increase in goblet cells, lymphoid hyperplasia, foci of endothelial proliferation, lymphatic dilatation and tubercle formation. These tubercles apparently do not contain acid-fast bacilli, do not undergo caseation necrosis but rather either slowly show hyaline or fibrous changes or are obscured by secondary inflammation. Subsequent to

the primary process, the secondary inflammatory process begins with ulceration due to decrease in the resistance of the mucosa and a numerical increase in intestinal bacteria. Following ulceration subacute and chronic cellular infiltration occurs. In the late stages, fibrosis and muscular hypertrophy of the intestine are prominent.

Present classifications — acute, subacute and chronic; ulcerative and hyperplastic — are based on the secondary inflammatory changes and are not concerned with the primary process.

It appears possible that the etiologic agent or factor responsible for the primary process is carried by the fecal stream and gains entrance into the interstitial spaces and lymphatics through the physiologic activity of the small bowel. Present surgical procedures appear to be palliative for they are concerned only with the intestinal lesion.

The possible tuberculous etiology of regional enteritis has been extensively re-investigated both by cultural methods and animal inoculation. A total of 1762 cultures and 131 animals were inoculated with material from the lesions of 43 patients with regional enteritis. All cultures and animals were negative for *Mycobacterium tuberculosis* and *Mycobacterium paratuberculosis* (Johne's bacillus). The significance of positive cultures of acid-fast bacilli in three cases is not known as the organisms did not grow on subculture and could not be identified.

These findings, if accepted on the basis of data included in this thesis, make it unnecessary for future workers who may desire to investigate this problem to be concerned about an alleged tuberculous or paratuberculous etiology. Consequently

they can concentrate their efforts on other factors of possible etiologic significance.

Microfilm copy of complete manuscript of 94 pages, \$1.18. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-736.

HISTORY

HISTORY, MODERN

HUMAN NATURE IN POLITICS: A STUDY OF WALTER LIPPMANN

(Publication No. 5453)

Earl Samuel Beard, Ph.D.
State University of Iowa, 1953

The study examines the writings of the journalist, Walter Lippmann, from the beginning of his career in 1910 until the publication of his well-known work, The Good Society, in 1937. The purpose has been to discover and analyze the ideas of human nature underlying his comments, criticisms, and proposals concerning social adjustments at the level of politics.

Early in his writing career Lippmann began to think of human nature against a background provided by the psychology supporting the then little-known theories of Freudian psychoanalysis. From 1913 until after the first World War, at least, he argued that the function of politics was to encourage a social environment conducive to the gratification of human instinctual drives along channels leading to the welfare of the community as a whole. He gave up this approach during the early 1920's as he became newly appreciative of the vast complexity of the social environment in the modern world. Any useful application of the Freudian principles of sublimation and adjustment to reality was impossible, he reasoned, since the real environment was obscured by many local pseudoenvironments. The real environment, as he now thought of it, was knowable only with the help of experts trained in the methods of social science.

Following his abandonment of the Freudian postulates, Lippmann fell back upon the general instinct theories of his former teacher, William James, and stressed the instinctive response of individuals to the immediate, local environments in which they moved — with an emphasis upon the conditioning role of environment. Under the assumption that environmental diversity and ignorance of the real world made it impossible for the mass of citizens to decide intelligently what political policies should be pursued in the interests of the general welfare, he assigned this task to a class of social scientists which was to function as an agency of government.

Again, sometime during the mid-1930's, Lippmann changed his mind. Frightened by the establishment of totalitarian regimes abroad, he came to the conclusion that individual liberties were constantly in danger wherever a centralized political structure exercised the functions of planning and social control. Hence he insisted that the only safe method of social control in a society of many environments and, consequently, of great diversity of interest, was a reliance upon the principles of the common law. The traditional law, Lippmann believed, was trustworthy because it had been forged during the period in which the idea of human dignity had become an ideal of western civilization.

Microfilm copy of complete manuscript of 243 pages, \$3.04. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-737.

NAZI WAR AIMS: THE PLANS FOR THE THOUSAND YEAR REICH

(Publication No. 7209)

John Robert Bengtson, Ph.D.
State University of Iowa, 1953

The purpose of this dissertation is to describe how the Nazis intended to reorganize Europe had Germany been victorious in the Second World War. They had formulated their plans for the future organization of Europe in great detail years before the outbreak of the war. The key to Nazi planning is the issue of race. The Nazis believed in their racial theories, and they fought the war for the purpose of putting these theories into practice. Hitler was the absolute ruler of Nazi Germany, and he stands out as the master planner of the Nazi movement. But there was little if any disagreement between Hitler and the other leaders of the Nazi Party. They were all essentially of one mind.

The dissertation is drawn in the main from Hitler's own statements as found in Mein Kampf, in Hitler's Tischgespräche im Führerhauptquartier 1941-1942, as recorded in the writings of Hermann Rauschning, and Otto Strasser, in the diaries of Goebbels and Ciano, and elsewhere, from the captured German documents that were used by the

allied prosecution staffs at Nuremberg, and from the Nuremberg trial records.

The Nazis considered the English, the Italians, and the Spanish as Nordic peoples. Under Hitler's "New Order" they were to be nominally independent of Germany, and were each to rule over an empire of their own. An Anglo-German alliance was one of the corner stones of Hitler's foreign policy. The Germans were to build their empire on the European Continent, and the English were to rule the seas. Right up almost to the very end of the war Hitler believed that he could reach an understanding with the English on this basis. The Italian empire in Europe was to include the lands along the eastern shore of the Adriatic Sea, Greece and a portion of France. The Spanish were to reign supreme in the Iberian Peninsula. The rest of Europe was to be ruled by Germany.

The Scandinavian Peninsula, Holland, Belgium, Luxembourg, Alsace-Lorraine, a large section of eastern France, Switzerland, Northern Slovenia, Bohemia and Moravia, Poland, the Baltic States and Russia up to the Urals were to be annexed directly to Germany and together were to form the New Greater German Reich. Within this huge space those who possessed "Germanic, Nordic, Teutonic blood" were to be Germanized, i.e. taught the German language, laws, and customs. The peoples of the West and North, with the exception of those of eastern France, were in the main considered to be of Germanic origin and thus suitable for Germanization. The Nazis expected to find millions of people in the East who possessed the desired blood from origins unknown. The eastern peoples were to have been given a racial examination to determine the quality of their blood. Those who passed the examination were to have been Germanized. There were "tens of millions" of people living in the East who were not expected to pass the racial examination. These were to have been exterminated by various methods such as systematic starvation, destruction of public health facilities, forced abortions, and so forth. The eastern spaces that were to have been made empty by the extermination program were to be resettled by Germans.

The Caucasus, Finland, Slovakia, Hungary, Romania, Bulgaria, Serbia, Turkey, and a greatly diminished France were to serve the New Greater Reich as vassal states. The Germans living in the vassal states were to be repatriated back to Germany and were to assist the other Germans in the "great task in the East" i.e. the German settlement of the East.

Microfilm copy of complete manuscript of 284 pages, \$3.55. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-738.

LI HUNG-CHANG AND THE HUAI-CHÜN

(Publication No. 7200)

Stanley Spector, Ph.D.
University of Washington, 1953

Li Hung-chang was one of a group of provincial leaders who came to power in China in the mid-19th century. During forty years in high office he became China's foremost statesman, military leader, reformer and diplomat. The principal basis of Li's power was his personal army, the Huai-chün, which was an outgrowth of gentry-led militia forces developed in Anhwei by Li's family and others during the T'ai-p'ing rebellion and organized into an army in 1862. Under the command of Tseng Kuo-fan and collaborating closely with the gentry in Shanghai, Li led the Huai-chün into Shanghai and contributed substantially to the final defeat of the T'ai-p'ings. In the process he built for himself one of the largest and strongest armies in China. To sustain his forces Li obtained control over the local bureaucracy and installed his own followers in revenue posts. Thus he obtained for himself a monopoly over the customs and likin revenues of Kiangsu. He contended with the Central Government and various military leaders for revenue control and gained his success at their expense. At Shanghai Li first came into contact with the West, and with the help of European officers and technicians he modernized the Huai-chün. The Huai-chün then suppressed the Nien rebels in a series of campaigns between the years 1866 and 1869.

Although Li's growing power was a threat to the Central Government, the Court was forced to call upon him for protection in 1870, and he was thereafter stationed with his army in Chihli, the Metropolitan Province. As Governor-general of Chihli Li continued to maintain sole command over the Huai-chün and to support it with likin and customs revenues from Liang-Chiang. His strength increased as he modernized the Central Government's lien-chün, and developed the modern Peiyang Navy. By officering these forces with Huai-chün men from his native district, and by controlling their sources of revenues and supplies, he made them powerful adjuncts of his Huai-chün organization.

Li led the "self-strengthening" movement to protect China through the use of Western military and industrial techniques. He developed modern arsenals, shipyards and technical schools in order to strengthen China's defences, but planned and located them so as to buttress his own military strength. He then introduced numerous reforms, among them a modern commercial steamship line, railways, telegraphs, coal and iron works and textile mills. These he used as sources of supply for his military organization and as sources of wealth and power for his group. Introducing a system of "merchant operation and official supervision," he granted special privileges and monopolies to his own economic enterprises. Although these enterprises pioneered in the use of Western technology, they seriously hampered the development of private enterprise and a free merchant class.

The military, political and economic edifice which Li had erected collapsed following the defeat of his Huai and lien armies and the destruction of the Peiyang Navy in the Sino-Japanese War of 1894-95. Li fell from power in the wake of military catastrophe and was recalled only after Peking was occupied by Western armies during the Boxer campaign. The Dynasty which Li had served, yet weakened, for almost half a century survived only a decade after his death in 1901. He was one of the last of the scholar-statesmen of old China, but in establishing new patterns of military power he left a legacy of institutions and leadership which has continued to influence Chinese social and political development in the 20th century.

Microfilm copy of complete manuscript of 665 pages, \$8.31. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-739.

AMERICAN ATTITUDES TOWARD MACHINE TECHNOLOGY, 1893-1933

(Publication No. 7268)

Lowell Tozer, Ph.D.
University of Minnesota, 1953

The period in American history from 1893 to 1933 marked a clear change in the popular attitude toward machine technology. There is much evidence that 1893 assumed technology to be a tool created by man for his convenience, while 1933 accorded such admiration to the machine that it verged upon worship. At the later date, man seemed willing to abandon his position of primacy in the world, and (regardless of the absurdity of the idea) to let machine technology dictate.

One way to gain insight into this difference is to examine an international exposition for each period, for each of the expositions celebrated progress. And progress presupposes a scale of values.

The World's Columbian Exposition of 1893 celebrated the progress made in the New World. An

analysis of that exposition reveals an attitude toward technology. Improvements in technology were admired mostly because they promised a better life for people. There was little admiration for machines per se. The architecture gave no clue to the presence of the machinery within the buildings: rather, there was an obvious effort to hide anything that suggested industrialization. All of the design at the fair showed an unwillingness to openly admire machinery, and frequently betrayed a real distaste. A congress of learned men met at the fair to enunciate the problems facing the world as the first step toward solving them. The fair as a whole, then, focused attention upon man, and tempered its admiration for technology to a degree that suggested a distaste for it, if not an actual fear.

The Century of Progress Exposition held in Chicago in 1933 presented a radically different picture. The fair was dedicated to technological progress. This of itself is significant. The exhibits paid almost no attention to whether improvements in machine technology would be of benefit to man. Admiration for machines was uncritical. The design of the fair further demonstrated this new attitude. The buildings were designed to look like machines. Other decorative features, such as sculpture, reflected the dominance of the machine to the virtual exclusion of humanity. There were no congresses: it was apparently assumed that modern technology could solve all problems. Technology was given uncritical admiration that sometimes approached worship.

A definite change in the popular attitude toward machine technology had taken place in America. Admiration had become overt. Fear and distaste had apparently vanished, and there is much to suggest that man had become willing to abandon his position of primacy in the world and to accept passively whatever his wonderful new technology should give him next.

Microfilm copy of complete manuscript of 299 pages, \$3.74. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-740.

LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, GENERAL

CLASS AND STATUS IN THE AMERICAN NOVEL, 1789-1850

(Publication No. 7255)

Arnold Gerhard Nelson, Ph.D.
University of Minnesota, 1953

This investigation in the sociology of literature explores two problems: first, the manner in which ideas and images related to class and status structures appear in the early American novel; and second, the effect of the novelist's social position upon these configurations. The first is accomplished by the methods of the history of ideas: definition of the two types of social structure and citation of examples from the novels. The second is accomplished by means of a quantitative content analysis of a representative sample of ninety-two novels together with a statistical description of the social origins and background of the ninety-two writers. Two extended case studies of individual novelists supplement the analysis of the series.

Class structure is defined as the realm of power, status structure as the realm of honor. The shift in the economic and political structure of the American republic from 1789 to 1850 — suggested by the terms "decline of the aristocracy" and "rise of the common man" — implies a shift from a status to a class society. Is this shift reflected in the novel? Throughout the period, the novel depends for much of its form on "status orientation," society seen as a divinely inspired and harmonious hierarchy based on honor. Is this vision referable primarily to literary conventions, or is it a reflection of the times or of the writer's class ideology or status position? Up to 1830, the typical novelist was an amateur writer and a member of a business family in the upper-middle income bracket. In the 1830's, he was a professional writer with serious artistic intentions and a member of a business or professional family, often of some national distinction. In the 1840's, he was a professional hack rising from a lower-middle to an upper-middle income bracket.

In order to impute "status orientation" and "class consciousness" (society seen as made up of contending economic groups) to the novels, the study focusses attention upon one specific topic: the image of the businessman. Some novelists were concerned with merchants, capitalists, and the industrialists primarily as status entities; others saw them also as class entities. A survey of Cooper's novels of the contemporary scene indicates that the image of the businessman is a useful index of the novelist's class and status perspectives. Students of Cooper have traced his changing perspective in relation to social and economic change; Cooper's fictional treatment of the businessman reflects this change.

The investigation employs objectively defined categories of contexts in which businessmen appear in the entire series. Every image of the businessman is included in a tabulation of business function; wealth, status, and power; and approval or disapproval. These categories are correlated with various sociological classifications of the novelists in the attempt to determine whether the writers' perspectives as citizens impinge systematically on their fictional representation of businessmen. The results of this analysis are inconclusive, but they suggest trends, and the method itself appears to be a valuable complement to impressionistic surveys and detailed textual analyses.

The investigation is intended to be a methodological and historical introduction to the study of the later and more complex novel. In the light of the trends suggested, an extended case study of Sylvester Judd's *Richard Edney and the Governor's Family* (1850) is presented. The themes of success and social harmony, the scene of the New England industrial town, and the status system of a somewhat realistic fictional community are discussed against the background of the novelist's life and times. A modification of the methods employed by W. Lloyd Warner in his "Yankee City" studies is used in describing the status system of the novel.

Microfilm copy of complete manuscript of 361 pages, \$4.51. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-741.

THE MORAL CONSERVATISM OF EDITH WHARTON

(Publication No. 7260)

Mary Lund Rice, Ph.D.
University of Minnesota, 1953

Literary historians and critics have treated Edith Wharton primarily as a social historian. In an essay, "Justice to Edith Wharton," reprinted in *The Wound and the Bow* (1947), Edmund Wilson, for example, asserts that in the novels written between 1905 and 1920 Mrs. Wharton was a "passionate social prophet," rebelling against the social standards of fashionable New York society. Her tone of pessimism and utter hopelessness, he says, was the result of an unhappy marriage.

The present study considers the theme of love, marriage, and divorce in her fiction. This theme bulks larger, by far, than any other. In spite of the presence in her fiction of much that is critical of the social and ethical decorum of upper-class society, she wrote primarily as a conservative moralist. From her second published story, "The Fulness of Life," 1891, through 1934, the date of her last completed novel, *The Gods Arrive*, and in short stories

up to her death in 1937, Mrs. Wharton held closely to this major theme. Furthermore, instead of an attitude of hopelessness and despair one finds a strong faith in the powers of the human spirit to overcome environmental factors and live by moral values. Examination of Percy Lubbock's Portrait of Edith Wharton (1947) and Edith Wharton's A Backward Glance (1934) suggest that the tensions of her private life served only to deepen her conservative ethical views.

This study attempts, then, to define the central theme of Mrs. Wharton's serious fiction. Whenever a personal moral obligation exists, she opposes divorce, believing, like George Eliot, whom she closely resembles, that in the interests of a stable society and the happiness of the individual, passion must be subordinated to duty. In Ethan Frome Ethan's duty is to his wife, who without him would be destitute; in The Age of Innocence Newland Archer's duty is to his wife and unborn child. Stories such as "The Choice," "The Letters," and "Permanent Wave" suggest the view that husband and wife are "knitted together at the roots, in spite of superficial divergencies." The Custom of the Country, The Children, and Twilight Sleep are strong protests against promiscuous marriages and easy divorces.

Edith Wharton's persistent upholding of the domestic virtues appears to have a philosophical basis. She feels that "broadening and deepening the individual existence," relating it to "all the mighty sum of human striving" should be man's major concern in life and that this object is best attained in what gives "continuity" to life, that is, the traditions, culture, the old home, whatever links the individual to the past, and what is more important, that which relates the individual to the future, the child. This theme is found in such works as Sanctuary, The House of Mirth, The Age of Innocence, A Son at the Front, Hudson River Bracketed, and The Gods Arrive.

Mrs. Wharton in her critical writings, The Writing of Fiction and numerous articles in the periodicals, reveals a strong belief in the organic relationship of the elements in fiction, giving primary importance to theme. Thus we assert that a knowledge of the thematic content of her fiction opens the way to further critical insights into her and her work, for instance, the function and poetry of her nature imagery, her tone of compassion (irony has hitherto been the quality stressed), and her creation of character.

Microfilm copy of complete manuscript of 175 pages, \$2.19. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-742.

THE COMIC ELEMENT IN BEAUMARCHAIS'
LE BARBIER DE SEVILLE AND
LE MARIAGE DE FIGARO

(Publication No. 5504)

Frank Boardman Wood, Ph.D.
State University of Iowa, 1953

An examination has been made of the comic element in Beaumarchais' le Barbier de Seville and le Mariage de Figaro. The aim has been to obtain, through analysis of the dramatic elements of character, action, and dialogue, some precise information concerning Beaumarchais' expression of the comic. Chapter I is an examination of character and action in which it is shown that the comedy of action and that of character are closely linked. Considered independently, action is seen to assist the comic atmosphere by maintaining for both sides of the intrigue a persistent alternation of advantage and disadvantage which precludes a systematic progress of the action, hence allows nothing to be resolved until the last scene of the play when an entirely reassuring termination of difficulties is realized. In terms of character it is seen that there is relatively little psychological development, that the relationship between principal figures is fairly static, that sympathetic personalities remain sympathetic and demand no deeper preoccupation with them, that all of the characters are possessed of considerable wit, a fact which lends something more to their comic aspect and minimizes the degree to which they are to be taken seriously.

Beaumarchais' greatest originality and the richest source of his comic effect is found in a consideration of his dialogue. Chapter II is devoted to an analysis of the mechanics of his comic style in an effort to discover the procedures which he has used to stimulate a laughter founded exclusively upon dialogue. It is discovered that, in general, it is wit, especially an ironic wit, which governs the comic effect in this area, while, in terms of procedure, it is the transposition of values which most consistently realizes the author's comic intention. Each of several procedures which supplement the transposition of values is in turn subjected to a statistical analysis of the frequency of its use and is further analyzed in terms of the relatedness or non-relatedness of its parent dialogue to the comedy of character and action. It becomes clear that for the most part this relationship does exist, indicating, thus, a total integration of comic effects. In a word, then, a detailed consideration of character, action, and dialogue reveals a generous association of these three elements to achieve a total comic impression which finds its most distinctive characteristic in the expression of wit.

Microfilm copy of complete manuscript of 209 pages, \$2.61. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-743.

LANGUAGE AND LITERATURE,
MODERNHUGO VON HOFMANNSTHAL AND PEDRO
CALDERÓN DE LA BARCA: A
COMPARATIVE STUDY

(Publication No. 7488)

Vernon Lockwood Anderson, Ph.D.
Stanford University, 1954

Since the death of Hugo von Hofmannsthal in 1929, an extensive reinterpretation of his life and works has been in progress. Competent critics place an increasingly heavy emphasis upon the significance of Calderón in the writings of Hofmannsthal.

Although Hofmannsthal's interest in Calderón extended over a period of more than three decades, the Austrian poet concentrated his attention upon the Baroque master only during the last twelve years of his life, from 1917 to 1929. It was Hofmannsthal's intention to establish Calderón in the permanent repertoire of the Austrian theater, and to this end he recast four of the Spaniard's dramas: a *comedia de capa y espada* ("La dama duende"), an *auto sacramental* ("El gran teatro del mundo"), a *comedia mitológica* ("La hija del aire"), and a *comedia filosófica* ("La vida es sueño"). The two-fold objective of this investigation was: first, to compare the plays of Hofmannsthal with Calderón's original dramas with respect to plot, characterization, theme, tributary ideas, dramatic structure, and language; and second, to evaluate and interpret the principal differences in terms of the distinctive temperament, artistic talent, literary taste, and philosophic viewpoint of each of the two poets.

Hofmannsthal's translation-adaptation of "La dama duende," "Dame Kobold," differs from the original principally in characterization and language. Calderón's Don Luis is changed from a noble *galán* to a cynical malcontent. The figure of the *gracioso*, Cosme, achieves greater reflective depth and drollery in the Hofmannsthal version. Calderón's rhymed verse, rich in metaphor and allusions to classical myth, has been transformed into terse, highly idiomatic prose, and most of the long, often involved speeches in the Spanish play have been replaced by shorter speeches which are highly differentiated as to character.

The plot of Calderón's *auto sacramental*, "El gran teatro del mundo" was considerably altered in the Hofmannsthal adaptation, "Das Salzburger Grosse Welttheater." The Beggar displays a constant attitude of humility in the *auto*, but undergoes an inner transformation in the "Welttheater," from potential anarchist to dynamic exponent of Christian love. To the original allegorical figures presented by Calderón, Hofmannsthal added several others, among them the Mephistophelian *Widersacher* and God's plenipotentiary, *Tod*.

Calderón's "La hija del aire" presents Semiramis, the sensual, power-mad goddess-queen of Assyria. Hofmannsthal's unfinished dramatic sketch, "Semiramis: die beiden Götter," depicts the gradual,

painful transformation of the heroine, under the influence of her son Ninyas, from *Herrscherin* to *Priesterin*. Ninyas, in the latter play, is an ideal, composite personification of Adonis, Lao-tse, and Christ.

In "La vida es sueño," Prince Segismundo overcomes his predisposition toward violence, pride, and sensuality by the enlightened exercise of the free will, *el libre albedrío*. Hofmannsthal's "Der Turm" presents a Sigismund who is already a spiritually disciplined, morally pure individual. He is a willing martyr to his ideal of peace through non-violence and love. "La vida es sueño" is a pseudo-historical drama of seventeenth-century Poland; "Der Turm" is a drama of twentieth-century, proletarian revolution.

Calderón was completely in harmony with the religious, political, and philosophical convictions of his social class and his era. He was a patriotic Spaniard, a responsible representative of the nobility, and a fervent Catholic. His style and language were probably influenced more by Luis de Góngora than by any other writer, *gongorismo* (in its various national manifestations) being the strongest literary current of seventeenth-century Europe. Hofmannsthal was likewise a patriotic nobleman, but he was also an internationalist and a cultural historian, whose greatest hope was to see a moral and spiritual regeneration of Europe, encompassing a renaissance of the truest values, the most enduring political forms, and the greatest ideals of the past.

Microfilm copy of complete manuscript of 205 pages, \$2.56. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-744.

W. B. YEATS AND T. S. ELIOT:
POETIC DRAMA AND MODERN POETRY

(Publication No. 7489)

Herbert Blau, Ph.D.
Stanford University, 1954

When T. S. Eliot wrote his first essays on the drama in the 1920's, he called for a revolution in principles. On the one hand, he was opposed to the mechanistic attitudes derived from Ibsen and defended by William Archer; and on the other, he wanted to counteract the tendency, originating in Charles Lamb, to treat the drama merely as literature. He wanted a drama that would be formal, conventional, ritualistic.

Eliot's pronouncements on poetry and drama have been credited with changing style and taste in modern literature and with restoring to poetry and drama a rational intelligence that they had not exhibited since the seventeenth century. Though the achievement of Eliot need not be underestimated, it is not sufficiently recognized that his ideas on both poetry and drama are neither as novel nor as rational as we are led to believe by most critics, and that in so far as his dramatic theory and

practice are concerned, he had been anticipated by W. B. Yeats. Though one is usually considered the last of the Romantics and the other the first of the modern classicists, their theories of the drama are in the same tradition, and this is so because their ideas on poetry are in the same tradition.

This tradition, however, is not traditional — in the sense that Eliot himself uses the word in his famous essay "Tradition and the Individual Talent." Both Yeats and Eliot see the drama as a vehicle for the expression of the most intense, sometimes the most inexplicable emotion. They are intellectuals who cerebrate over the instinctive life and intuitional theories of art; and they conceive of action in the drama not as the imitation of representative human nature, but as the symbolic reflex of passion. What critics of their drama fail to see is that what is missing in their drama is also missing in their thought, and that the failings and distortions of their dramatic procedure are the failings and distortions of a tardy Romanticism, including its conception of the nature of poetry. Because of the renown of Eliot and Yeats, and especially Eliot's prominence as a critic, this is the standard conception today; and unless there is some further revolution in principle, there would seem to be little hope for a significant revival of poetry in the theater.

The dissertation attempts to substantiate these views by analyzing at length the critical writing and plays of Yeats and Eliot. It attempts to show that both poets are extreme representatives of that "dissociation of sensibility" which Eliot has described as having begun in English literature about the time of Milton and Dryden. Along with Ezra Pound, who influenced them both, they are important figures in the history of modern obscurantism.

For some time there have been theories abroad — such ideas as "spatial form" and "psychological progression" — defending the poetic methods of Eliot and Yeats. One of the important tasks of this dissertation has been to examine these theories in order to understand the quality of their appeal and the consequences of their adoption. Moreover, in order to clarify the deviation of Yeats and Eliot, a chapter has been devoted to a restatement of an idea of dramatic form which is inherent in both Greek and Elizabethan drama. It is the intention of this chapter to define the peculiar ethical equilibrium of tragic drama and to show how poetry or, more accurately, language is properly ordered, as character and thought and spectacle are ordered, in terms of a probable and necessary action.

Microfilm copy of complete manuscript of 677 pages, \$8.47. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-745.

THE DOCTRINE OF REPENTANCE AS A FORMAL PRINCIPLE IN SOME ELIZABETHAN PLAYS

(Publication No. 7518)

Dolora Gallagher Cunningham, Ph.D.
Stanford University, 1953

This dissertation is concerned primarily with the analysis of dramatic structure in relation to certain fundamental patterns of thought by which the structure is achieved. It concentrates on the function of Christian repentance, conceived as a prevailing Elizabethan scheme of thought and feeling, as a formal or organizing principle by which plot is constructed in a selected group of plays. An important part of the argument is that in those plays where repentance is successfully used, its principles are closely related to commonly accepted doctrines of literary form and actually become the positive basis of conventional dramatic characterization.

The introductory chapter attempts to define the nature of Christian penance as an habitual attitude of mind and a scheme of thought and feeling which helped to provide the fundamental principles for apprehending and judging human action and character. The habitual Christian disposition towards human nature as enslaved by original sin and yet charged with the responsibility of choosing the greater good, made repentance a necessary part of every man's life and therefore easily available as a formative principle to the Elizabethan dramatist.

Repentance, dramatically speaking, is not merely a convention in the superficial sense (though, of course, it may be only that in particular instances), but also a method of understanding and disposing one's materials within the specific conditions of dramatic form. Briefly, then, repentance may operate in a play (1) as a principle of plot; (2) as a principle of characterization, especially with reference to sudden changes in the course of the action; (3) as a secondary principle of order in handling details of action so as to direct them to the central meaning of the plot; (4) as the focal point of a generally accepted system of morality and, thereby, as an implicit principle of judgment functioning within the work of art.

The chief concern of this study is not with the doctrinal content of repentance as a sign of the prevailing philosophy, but rather with its actual function as a formal principle in the construction and so in the understanding of certain relevant plays, and especially in the understanding of character where its motivation has seemed unrealistic to modern critics. The general progression is from plays in which repentance is unsuccessfully used as an expedient device to plays in which it is used responsibly as a definite means of realizing the particular purpose of the respective plots.

The unprincipled use of repentance is held to be a condition of artistic failure in *The Maid's Tragedy*, *Philaster*, *A King and No King*, *A Woman Killed with Kindness*, and *The Honest Whore*. The responsible

adaptation of repentance to the requirements of dramatic form is, on the other hand, a principle of plot in Edward II, Antony and Cleopatra, Love's Labour's Lost, All's Well That Ends Well, and Measure for Measure.

The main purpose of this organization is to determine, through close analysis of specific plays, the extent to which repentance can be considered a part of the positive basis for dramatic action and characterization. To this end, I have chosen a group of plays which furnish clear examples of sensational and sentimental corruption of the traditional ethical system; and a second group wherein a consideration of repentance seems essential to a just interpretation of the plays.

Microfilm copy of complete manuscript of 259 pages, \$3.24. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-746.

JAMES JOYCE'S REVISIONS OF FINNEGANS WAKE: A STUDY OF THE PUBLISHED VERSIONS

(Publication No. 7233)

Fred Hall Higginson, Ph.D.
University of Minnesota, 1953

This dissertation is a study of the relation between Joyce's revisions of his fiction, particularly Finnegans Wake, and his artistic theory, as expressed by Stephen Dedalus (Joyce's alter ego) and by Joyce himself. The conclusion reached is that Joyce's artistic theory remained constant throughout his career, despite the diversity of techniques which the theory supports. Chapter I discusses the theory itself; Chapter II discusses its operation in Dubliners, A Portrait of the Artist As a Young Man, and Ulysses; Chapter III discusses the influence of Giambattista Vico on the artistic theory and on Finnegans Wake; and Chapter IV discusses the revisions of Finnegans Wake.

Stephen Dedalus assumes that any valid aesthetic must begin with the one factor common to all observers: the mechanism of apprehension itself. The phases of apprehension (perception, recognition, and satisfaction) may then be paired off against the three Thomistic qualities of beauty (wholeness, harmony, and radiance). The phase of apprehension called satisfaction thus corresponds to the quality of beauty called radiance; Stephen equates radiance and quidditas. Stephen also suggests that the process of creation is analogous but somehow opposite to the process of apprehension. Three stages of creation (selection, synthesis, and factification) may be deduced from appropriate contexts; the device by means of which Joyce makes the transition from apprehension to creation is the "epiphany": a sudden "showing forth" of the inner reality (the quidditas) of an object to an observer. The third phase of apprehension (satisfaction) is linked by means of the "epiphany" to the first phase of creation; it is hoped that what has satisfied one observer (the creator) will, when recorded, satisfy other observers in their turn.

Joyce's artistic theory is original principally in his use of the term "epiphany."

Examinations of the revisions of "The Sisters" (a short story from Dubliners), of Stephen Hero (an early version of the Portrait), and of Ulysses show that by revision Joyce attains, by varying means and to varying degrees, the goals of economy, precision, and sharpness of focus. Economy predominates as a goal of the revisions of Stephen Hero; precision predominates as a goal of the revisions of Ulysses.

Vico's influence on Finnegans Wake is threefold: it affects the form (epical), the structure, and the language. The revisions of Finnegans Wake are directed principally toward sharpening the focus of the language so that the reader is forced into a realization of the Vichian continuity of history, myth, and languages. The revisions of Finnegans Wake may be shown to arise from the same artistic theory which produced the earlier revisions.

The dissertation proper is followed by an appendix which presents published texts and variants of and commentary on the "Anna Livia Plurabelle" chapter of Finnegans Wake. In addition to providing extensive explication, the appendix supports the contentions made in the dissertation that the language of Finnegans Wake is basically English, that the revisions of the language are principally structural, and that the language of Finnegans Wake is a device for assuring the intimate interpenetration of structure and materials.

Microfilm copy of complete manuscript of 325 pages, \$4.06. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-747.

A STUDY OF THE RELATIONSHIP OF THEMATIC AND STYLISTIC VARIATION IN JEREMY TAYLOR'S PROSE

(Publication No. 7519)

James Roy King, Ph.D.
University of Pennsylvania, 1952

Supervisor: Matthias A. Shaaber

This dissertation attempts to synthesize two aspects of Taylor studies hitherto unfortunately separated by showing that a very close relationship exists between Taylor's major themes and the several styles through which he expressed his ideas.

Three principal moods or viewpoints are noted in Taylor and are traced in detail throughout his biography, his thought, and certain isolable aspects of his style. Two of these attitudes constitute opposite poles: a bitter, negative view point, and a more optimistic, positive attitude. The genesis of the first attitude is discovered in Taylor's difficult experiences during the Civil War and in Ireland, while the second attitude is traced to his days at Oxford and Cambridge, his friendship with the important liberals of his day, and his service to the Church of England. A third viewpoint, quiet,

intimate, and unphilosophical, is traced to his relationship with his chief patrons, the Carberrys, Conways, and Evelyn.

These attitudes are further traced in discussion of the principal forms within which Taylor worked — the devotional guides, sermons, casuistical writings, and books on toleration and popular errors. Taylor's best work is found to be that cast into smaller forms, and certain links between logical structure and stylistic clarity are suggested.

In three chapters which follow, the pattern of Taylor's thought is developed. Basic to his thinking is a gentle agnosticism — the conviction that man is unable to know with certainty. From this negative attitude rises Taylor's sense of human infirmity, his aversion to speculation, and the confidence that through reason, scripture, and knowledge of the church fathers a degree of knowledge is possible. Illation (the doctrine of probability) and mystical intuition constitute other avenues to knowledge. Taylor's ideas on toleration and piety, and his devotion to the Anglican Church are discussed as alternatives to piety. A final section is devoted to discussion of commonplaces — Taylor's thought on the state, friendship, death, Stoicism, and casuistry.

In Chapter Seven certain isolable aspects of the style are considered — Taylor's use of anecdote, the Bible, words, epigram, imagery, and the classics. Objections to consideration of his style in rhetorical terms are considered. The section closes with an account of Taylor's satire and his observations of human behavior — matters not strictly stylistic but suggestive again of the two poles between which Taylor moves.

In the final chapter the existence of five styles in Taylor's prose is noted and these styles are differentiated on the basis of length of period, structural complexity, and presence of *cursum*. The most clearly defined of these styles are found to conform to accepted patterns of Taylor's day — the Ciceronian, the Curt, and the Familiar styles. The Latinic style, used for scholarly writing, and a hard, precise style used for argumentation are of less importance. The suggestion is made that Taylor's important themes are to be linked with the major styles: the Ciceronian with his positive remarks on holy living, Anglicanism, and the life of Christ; the Curt with such negative themes as human sin and ignorance, anti-Catholicism, and casuistry; the Familiar with comments on the small joys of life and his letters to his friends. Finally, certain reevaluations of major works are made: the sermons published posthumously are to be highly regarded for treatment of lofty themes in the Ciceronian manner; in the *Ductor Dubitantium* are noted many pages of great clarity and deep emotion; while the presence of the Curt style in *Holy Dying* makes it one of the most stylistically and tonally complex of the devotional books.

Microfilm copy of complete manuscript of 419 pages, \$5.24. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-748.

SHAKESPEARE AND THE CHRISTIAN VIEW OF MAN

(Publication No. 7500)

Reverend Joseph George Milunas, S.J., Ph.D.
Stanford University, 1954

This study is an investigation of the extent to which certain of Shakespeare's plays have been influenced by Christian teaching on the nature of man. The introduction examines, therefore, such fundamental concepts of Christian thought about the nature of man and his destiny as the necessity for grace, the importance of final perseverance in grace, the fact of interior conflict in man's nature, the role of trial and temptation in the life of man, and the spiritual states of guilt and repentance. Attention is also directed to the tenets of the Pelagian ethic and to certain basic differences between Catholic and Protestant conceptions of human perfection. The dramatic implications of the Christian view of man are noted throughout the introduction.

The influence of these theological formulations is then examined in the following plays: *Measure for Measure*, *Hamlet*, *Othello*, *Macbeth*, *King Lear*, and *Antony and Cleopatra*. Each of these plays gives prominence to different aspects of the Christian view of man.

Measure for Measure contains an abundance of explicit doctrinal statement. It is, in fact, a critique of that view of human perfection, the Pelagian, which is directly opposed to the Christian. Man's need for grace and the Christian economy of trial and temptation are especially prominent in the development of character and action in this play.

In *Hamlet* the theological themes of guilt, repentance, acedia, and conformity to the will of God are to the fore. The theology appears principally in the tragedy's psychological and moral aspects, revealing the interior moral dispositions of the characters as they become involved in their tragic situations.

Othello is a study of inordinate human love in its theological dimension. The psychology of temptation and the consequences of yielding to it are forceably demonstrated by the dramatic action. Many of the important doctrines dealing with grace appear in the play, affording further exploration of human behavior under the inspiration of Christian theological teaching.

The consequences of the rejection of the natural and supernatural orders are explored in *Macbeth*. The predicament of the sinner remaining fast in his sin is dramatically revealed. The play is especially noteworthy for the implicit use made of the theology of final perseverance.

The Christian view of man inspires the action of all the above plays with a surprising consistency. Two plays with a pre-Christian setting, *King Lear* and *Antony and Cleopatra*, are studied finally with a view to discovering whether Christian thought controls Shakespeare's intention in them or whether some other view of man displaces the Christian ethos.

King Lear is centrally informed by Christian doctrine. It is a study in the range of human behavior

and the possibilities of man's nature for good and evil in the light of christian thought about man. The process of spiritual regeneration is strikingly displayed in the radical change of mind and will wrought in Lear and Gloucester. They progress from seriously imperfect moral dispositions to an acceptance of and conformity to the divine will.

Antony and Cleopatra does not, however, use the full resources of the Christian view of man. The influence of Christian teaching on the nature and sources of interior conflict in man does inspire the portrayal of Antony's moral decline. The play is a subtle study of the psychology of the sinner.

The preceding study of these six plays leads one to conclude that Shakespeare's thinking about the nature of man was permeated by the traditional Christian account of the nature of man and his destiny.

Microfilm copy of complete manuscript of 378 pages, \$4.73. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-749.

ASA GREENE, NEW ENGLAND
PUBLISHER, NEW YORK EDITOR
AND HUMORIST, 1789-1838

(Publication No. 7259)

Arthur Lachlan Reed, Ph.D.
University of Minnesota, 1953

Asa Greene, born in Ashby, Massachusetts, February 11, 1789, graduated from Williams in 1813 after two years there. He took an M.D. at Brown in 1822; earned an honorary M.D. from the Berkshire Medical Institute in 1827 and an honorary M.A. from Williams in 1828. Meanwhile he was a bookseller and publisher. He edited the weekly Berkshire American in Pittsfield, Massachusetts, from December 14, 1825, until February 9, 1827, and in North Adams until June 18, 1828. Though it contained more didactic than humorous material, it was amusingly written. Its successor, the Socialist (May, 1828, until May, 1829) was more of a literary journal than the American, but it published fewer original pieces than cullings from other papers.

When these papers failed, Greene moved to New York City, where he remained as bookseller, editor, and humorous novelist until his death on December 31, 1838. He edited the weekly Constellation between November 21, 1829, and September 8, 1832. The paper was undistinguished save for its slight humorous sketches in the native idiom, its inauguration of the custom of reporting police court cases, and its series of Enoch Timbertoes letters in 1831 and 1832, perhaps by Greene. Late in 1832 Greene and Francis Stebbins published a short-lived daily, the New York Citizen. Between this time and his editorship of the daily New York Transcript from March 10, 1834, until approximately December 4, 1835, Greene published four humorous and satiric novels: A Yankee Among the Nullifiers (1833), The Life and

Adventures of Dr. Dodimus Duckworth, A.N.Q. (1833), Fibbleton's Travels in America (1833), and The Perils of Pearl Street (1834). He also practised medicine. The Transcript is important in the history of the popular penny dailies. It specialized in unbiased news, sensational criminal and sporting reports, humorous sketches, parodies, burlesques, and hoaxes.

Greene's four novels, each written under a different pseudonym, are loosely organized and almost plotless satiric and humorous sketches. A Yankee is a satire on Southern political ideas and social customs which sports humorously with Nullification, duelling, and economic theories. It contains some good sketches of Negroes and Yankee peddlers. Dr. Dodimus Duckworth is a pseudo-biographical satire on medical quackeries and country superstitions in rural Massachusetts. The style is burlesque; the idiom is frequently the vernacular. The book lacks consistent character portrayal, but it is full of amusing incidents and well-conceived satire. Fibbleton's Travels burlesques English visitors like Mrs. Trollope and Captain Hall. It is apparently a parody of Isaac Fidler's Observations. Fibbleton, once His Majesty's barber, reports on his visit with stupid and flippant rancor. Jo Strickland, Enoch Timbertoes, and Jack Downing are introduced as foils to Fibbleton. The Perils of Pearl Street is a facetious exposure of mercantile trickeries in New York City in the guise of an autobiography. Though it is accurate in details, the book is labored satire. A Glance at New York (1837) is a facetious and informative guidebook to the life of the city.

Greene's books were favorably reviewed, but only A Yankee appeared in a second edition. The verisimilitude of Greene's characters, of the scenes in which they move, and, at times, of the language they use is Greene's forte. Stereotypes of style, self-consciousness, and didacticism, apparently derived from his formal education, devitalize much of his work. In spite of his skills of characterization and satiric treatment and although he provides a variety of excellent miniature sketches, Greene did not create a match for such "crackbox philosophers" as Downing or Biglow nor for such roarers and raconteurs as Crockett, Jones, or Lovingood.

Microfilm copy of complete manuscript of 223 pages, \$2.79. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-750.

THE FUNCTION OF EVIL IN SCHILLER'S DRAMAS

(Publication No. 7520)

Eric Rosenbaum, Ph.D.
University of Pennsylvania, 1951

Supervisor: Dr. Ernst Jockers

Schiller's concept and treatment of evil is determined by his metaphysical dualism which reflects the religious antinomy between God and the devil.

Ethically, these antipodes consist in the antithesis of the moral and the immoral.

Schiller's disposition and his *Urerlebnis*, derived from the Old Testament-Pauline religion of his father and the propitiating pietism of his mother, laid the foundation for a twofold conception of the deity: (a) the theistic view of a righteously judging God, transcending all material existence and thus accentuating the metaphysical dualism of *Sinnlichkeit* and *Sittlichkeit*; and (b) the God of grace, whose pantheistic tendencies engender the ideal union of flesh and spirit. Studies of medicine and Kant cemented the one conviction; an acquaintance with Leibniz and Shaftesbury, and the association with Goethe furthered the other. This twofold aspect of the divine manifestation strongly colors the function of evil in the dramas.

In the early dramas — *Die Räuber*, *Die Verschöpfung des Fiesco*, and *Kabale und Liebe* — a decided metaphysical dualism asserts itself most drastically, for the poet depicts the principal evil-doers as veritable devils who, while attacking social, moral or political conditions, wage an exterminating war against the omnipresent deity. God, counter-acting with the weapon of supreme justice, metes out retribution according to the severity of the transgression.

The transitional *Don Karlos* and the mature *Wallenstein* trilogy evince Schiller's endeavors towards a psychological and aesthetic reconciliation of the Biblical-Kantian rigorism. Here the dramatist seeks to emphasize the psychological and sociological interpretation of evil without, however, acquitting the evildoer of his ultimate responsibility and guilt. God's omnipresence is less manifest, but his sovereignty as the inflexible judge remains unbroken in resisting dethronement by earthly, self-styled gods.

As a strong reaction to the secularization of evil in *Wallenstein*, Schiller's metaphysical dualism reasserts itself vigorously in *Maria Stuart* and *Die Jungfrau von Orleans*. In these plays evil appears not so much as an inherent, demonic trait of the human soul, but rather as an unconscious deviation from original purity, incurred by a natural impulse towards existential fulfillment. As a result, Christian grace and redemption take the place of rigoristic retribution; a total expurgation of evil is permitted by means of a perfect integration of God and the soul.

Although in *Die Braut von Messina* modern aspects of heredity are introduced to motivate partially moral transgressions, evil assumes ontogenetic proportions, and the wrongdoers are held as much accountable to God as in the previous plays.

The same responsibility exists in *Wilhelm Tell* where individual oppressors presume to act on behalf of an allegedly irresponsible collectivity, Austrian despotism. Here the poet summons not only individuals but whole nations before the divine court. In so doing Schiller anticipates present endeavors towards the establishment of an ethically and religiously guided world tribunal.

The problem of an interdependence of individual and collective guilt might have played a prominent

part in *Demetrius* where the complex relationship of circumstances and free will is treated. However, the fragmentary form of the drama makes any interpretive venture highly conjectural.

Although ever yearning for an artistic bridging of the hiatus between materia and spirit, Schiller's metaphysical dualism, apparent in his early plays, reappears consistently and irrepressively until the end of his dramatic career. Regardless of whatever interpretation may be given to evil, man, in whose character and by whose actions it manifests itself, is always held accountable to divine justice which rules supreme but is sufficiently flexible to deal with each case on its own merit. Thus each individual must face the God whom he deserves.

Microfilm copy of complete manuscript of 311 pages, \$3.89. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-751.

AN EDITION OF THE COMPLETE POETICAL WORKS OF EDWARD TAYLOR

(Publication No. 6911)

Donald Elwin Stanford, Ph.D.
Stanford University, 1953

This edition, which was set up from the manuscript of Taylor's poems in the Yale Library, and from a microfilm of the manuscript, contains all the legible poems in English by Edward Taylor. Many of these poems have never been published. The text of the poems is collated with those poems previously edited by Thomas H. Johnson.

The edition includes an introduction, textual notes, explanatory notes, appendices, and bibliographies. The introduction consists of a life of Taylor, an analysis of Taylor's theology, and a critical evaluation of his poetry. The life of Taylor and the appendices contain copies of letters written by Taylor and Taylor's Diary. The analysis of Taylor's theology demonstrates that the seventeenth century New England Puritans were Calvinists and that Taylor himself was a Calvinist. The analysis refutes Thomas H. Johnson's theory that Taylor's theology was a Covenant Theology as distinct from a purely Calvinistic theology, and the analysis demonstrates that, in so far as Taylor was concerned, Calvinism and Covenant Theology were synonymous. The theological section also demonstrates that Taylor was orthodox in his attitude towards the Lord's Supper and refutes the interpretation of Kenneth B. Murdock and others that Taylor was unorthodox in his interpretation of the Lord's Supper. The critical section offers an explanation of Taylor's poetic practice, that is, his methods of putting his theological ideas into poetic form, and compares Taylor's poems with those of other metaphysical poets.

Microfilm copy of complete manuscript of 826 pages, \$10.33. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-752.

MARCEL PROUST: ASPECTS OF
ANGLO-AMERICAN CRITICISM

(Publication No. 7513)

Gerard Raymond Tougas, Ph.D.
Stanford University, 1954

The study of Marcel Proust presents a number of problems, the solution of which cannot be attempted, save by the specialist who is prepared to synthesize the enormous amount of material which has already accumulated on the subject of *Remembrance of Things Past* and its author. This dissertation purports to be a guide for future students of Proust, in pointing out a few of the main pitfalls of present day criticism, with particular reference to English and American commentators. These pitfalls have been given close examination in the three first chapters entitled: "The Intellectual Evolution of Marcel Proust;" "Involuntary Memory and Bergson;" "Feuillerat and Proust's Style."

Upon a correct interpretation of Proust's intellectual evolution hinge most of the problems discussed herein. By a careful analysis of *Remembrance of Things Past*, together with Proust's earlier writings, including *Jean Santeuil*, published posthumously in 1952, it becomes apparent that Proust's thought is characterized by an unusual singleness of purpose, the main aspects of which are discernible in his adolescent writings. This conclusion, though not revolutionary, has been overlooked by many critics in both the United States and England.

The nature of Proust's originality takes on a new light in view of the conclusion just stated. Involuntary memory, of which such brilliant use is made in *Remembrance of Things Past*, is not a reflection of Bergson's philosophy, as has been so often affirmed. American scholarship in particular has shown conclusively that the theme of involuntary memory, in its most general acceptance, can be found in numerous Romantic writers from Rousseau to the present day; also, that it was popular as a subject of scientific investigation in the second half of the nineteenth century. Contrary to what many critics have said, Proust has added little to our knowledge of involuntary memory, either as a literary or a scientific subject. His theories on involuntary memory are more a reflection of his own temperament, the evolution of which shows so little variation from adolescence to maturity, and owe some of their peculiarities to the general atmosphere of the age rather than to borrowings from any particular author. His highly subjective elaboration of involuntary memory appears as an original contribution to world literature only in that it is given an artistic and spiritual importance not to be found elsewhere.

It is also possible to show, by referring to Proust's relatively static philosophy of life, that to this singleness of purpose corresponds a unique style, the main characteristics of which remained unchanged throughout his life. A series of comparisons between earlier and later writings disprove one of the theses of Albert Feuillerat's controver-

sial but extremely influential book on Proust's method of composition¹, namely the thesis that Proust adopted more than one way of writing, according to the evolution of his philosophy.

Following the elucidation of these specific problems, the remaining two chapters are devoted to a more general discussion of the way in which American and English critics have approached the subject of Marcel Proust.

Particularly when compared with some of the major French critics, American and English commentators have been more critical of the man while less restrained in their praise of his main novel. Three aspects in particular of Proust's temperament have appealed to Anglo-Saxon readers: his humor, his powers of introspective analysis and above all, his mysticism.

American and English critics, when surveyed as a whole, have made a significant contribution to the study of Proust, especially with regard to the specific problems studied in the first three chapters. It would seem probable that their appraisal of Proust, which generally speaking, is somewhat higher than that prevailing among French critics, should, with time, tend to raise Proust's position among the outstanding novelists of the twentieth century.

The dissertation of which this is an abstract is written in French.

1. Albert Feuillerat, *Comment Marcel Proust composa son roman* (New Haven: Yale University Press, 1934) pp. 270.

Microfilm copy of complete manuscript of 202 pages, \$2.53. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-753.

WILLIAM MARION REEDY: A CRITICAL
BIOGRAPHY

(Publication No. 7180)

Fred Wilhelm Wolf, Ph.D.
Vanderbilt University, 1951

Supervisor: Professor Richmond C. Beatty.

William Marion Reedy (Dec. 11, 1862 – July 28, 1920) – one of three sons of Patrick Reedy, a police sergeant, and his wife, Anne (Marion), both Irish immigrants who settled in St. Louis – was the editor and proprietor of a weekly magazine called the *Mirror*. Having received his primary education in various parochial schools, Reedy attended the local Christian Brothers College, which in the 70's was one of the few very thorough schools in the Midwest in its classical curriculum. At the age of fourteen he enrolled as a day-scholar in the "humanities division" at St. Louis University, but after two years, he changed to the commercial course, graduating (1880) with the degree of Master of Accounts. Then followed approximately ten years' apprenticeship as a reporter on various local newspapers. In 1891 he joined forces with M. A. Fanning and "Red" Galvin

who had recently founded in St. Louis a weekly journal called the Sunday Mirror. Reedy, however, had previously garnered local fame for his reportorial work, particularly through his scoops on several widely publicized murders, and some national acclaim through his essays in Brann's Iconoclast.

By 1892 Mr. James Campbell, a wealthy traction magnate, had acquired the Sunday Mirror. He made his friend Billy Reedy the editor, and later (1896), tiring of the weekly expenditures incurred by publication, gave the magazine to him.

Having become notorious even as a "cub" reporter in his early twenties for his addiction to drinking and his way of life "in the brothels o' nights," he further made the ponderous affront to conventions by marrying two prostitutes among his three wives. These facts, to some extent, made him persona non grata in his home town.

Religiously, Reedy was something of a Deist or Transcendentalist with definite leanings toward Christian Socialism. His first divorce and a second marriage made him ipso facto non-Catholic. He was a member of no church and he followed no sectarian creed, but he believed in and carried out throughout his most charitable life the Golden Rule.

Politically, he was a Democrat, but he usually voted independently. The man (especially if he were inclined toward the Single Tax Program), not the party, determined his comments and his vote. Liberalism in politics, as eclecticism in the arts, gave the Mirror its reputation for considering all movements amiably.

Beginning as a kind of society and gossip sheet in newspaper format, the Mirror later under Reedy's management took on dignity and extended its scope, veritably growing to be a most reputable literary and critical paper known over the English-speaking world. Yet at its peak, its circulation probably never exceeded 10,000; usually it averaged between six and eight thousand. Nevertheless, the Mirror as the principal medium for cultural expression in the Midwest eventually became an honorable refuge for progressive minds and a conspicuous leader in progressive literary art.

As early as 1901 it was the theater in which many writers who have since won fame found their first audience: Percival Pollard, Ernest McGaffey, Harris Merton Lyon, Silas Bent, Sara Teasdale, Zoë Atkins, Fannie Hurst and others; after 1910 the pages of Reedy's magazine became almost dazzling with the galaxy of names that appeared on them: Theodore Dreiser, Maxwell Bodenheim, Edgar Lee Masters, Babette Deutsch, John Hall Wheelock, Vincent Starrett, Vachel Lindsay, Edna St. Vincent Millay, Charles J. Finger, Witter Bynner, Carl Sandburg, Amy Lowell, Robert Frost and others. Reedy also was one of the first to introduce to American readers such foreign celebrities as Galsworthy, Conrad, Yeats, Synge, A.E., John C. Powys, Lord Dunsany, Cunningham Graham, Padriac Colum, and Yone Noguchi. He helped to popularize Chekhov, Tolstoy, Gorky, Anatole France, Sienkiewicz, and Hauptmann; furthermore, he had translations made of significant foreign works and reprinted the translations in his Mirror.

The most distinctive feature of the Mirror was its refreshing independence — actually, the "Reflections" of the attitude of an editor who refused to ruckle to popular taste or to be swayed by mere majority opinion. As produced by Reedy, the Mirror was a genuine little magazine and a most satisfactory journalistic and cultural achievement.

Microfilm copy of complete manuscript of 264 pages, \$3.30. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-754.

LANGUAGE AND LITERATURE, LINGUISTICS

THE PHONOLOGICAL THEORY OF THE SCHOOL OF PRAGUE: AN EXPOSITION AND REVISION

(Publication No. 7248)

Herbert Merzbach, Ph.D.
University of Minnesota, 1953

The exposition of the phonological theory of the School of Prague has been based mainly on the definitions given in the "projet de terminologie phonologique standardisée" which the Cercle linguistique de Prague has worked out and in the *Grundzüge der Phonologie* by N. Troubetzkoy.

This exposition is preceded by an explanation of these phonetic definitions and classifications which underlie phonological descriptions according to the usage of the School of Prague.

The specific problems which are treated by this study in an effort to effect clarification and emendation are as follows:

- i. An attempt to clarify the opposition between Troubetzkoy and Vachek on the question of the "phonemic unit."
- ii. A comparison of the terms "realization of a phoneme," "actualization of a phoneme" and "range of performance of a phoneme" which are used by the members of the School of Prague with the terms "variant" and "allophone" preferred by other linguists.
- iii. The reasons why the distinction between the "fundamental variant" and the "accessory variants" cannot be determined through phonological means.
- iv. An analysis of the divergence between the School of Prague and other linguists concerning the concept of "phoneme" which has not been clearly stated in the linguistic literature.
- v. An important correction to the work of Troubetzkoy, the leader of the School of Prague, who in the question of "sound-similarity" agreed with prominent linguists of other schools.
- vi. A thorough discussion of the "contrastive and relative character of the phoneme" and a statement of the resulting requirements for its delimitation.
- vii. An investigation of the concept of "neutralization" in the exposition of the phonological system.

viii. (a) A discussion of the concept of "archiphoneme" which is intimately linked with the concept of neutralization.

(b) The extent to which the "archiphonemic symbol" must be used.

ix. The treatment of the distinction between "phonetic variations" and "phonemic — including morphophonemic — alternations," and of the delimitation of "defective distribution" and "neutralization."

x. An introduction by the writer of the concept of "logical archiphoneme," and an appraisal of its usefulness in the description of the structural pattern of a language.

xi. A correction of the Prague theory which admitted explicitly only the neutralization of "bilateral oppositions" by demonstrating the possibility of the "neutralization of multilateral oppositions."

xii. A discussion of the problem of "neutralization between several archiphonemes," and the introduction and justification of the concept of the "hyperarchiphoneme."

Microfilm copy of complete manuscript of 165 pages, \$2.06. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-755.

MATHEMATICS

CERTAIN PROBABILITY LIMIT THEOREMS AND TRANSFORMATIONS OF STOCHASTIC PROCESSES

(Publication No. 7225)

Robert Ernest Fagen, Ph. D.
University of Minnesota, 1953

Summary

Consider a sequence of independent, identically distributed random variables x_1, x_2, \dots having mean 0 and variance 1, and let s_n be the n th partial sum of these variables. A very general question arising in the study of probability limit theorems concerns existence and calculation of the limiting distribution of various combinations and normalizations of such partial sums. A complete theoretical answer has been given for a certain class of such functions of partial sums; this theorem is due to Donsker, and can be stated in the following manner:

Let x_1, x_2, \dots and S_n be as above. Let

$$x_i(t) = \begin{cases} \frac{S_1}{\sqrt{n}} & t = 0 \\ \frac{S_i}{\sqrt{n}} & \frac{i-1}{n} < t \leq \frac{i}{n} \end{cases} \quad . \quad \text{Let } R \text{ be the space}$$

of continuous functions on $[0,1]$ except for a finite number of finite jumps, and let C be the space of (continuous) sample functions of the Wiener process on $[0,1]$. Let F be a functional defined on R and continuous in the uniform topology on C . Then

$$\lim_{n \rightarrow \infty} P \left[F \left\{ x_n(\cdot) \right\} \leq \alpha \right] = P \left[F \left\{ x(\cdot) \right\} \leq \alpha \right]$$

at each point of continuity of the function of α in the right member.

One sees from the above theorem that the notion of measure of functionals defined on a stochastic process enter in in an essential way to the study of probability limit theorems; in particular, the Wiener process entered as the limiting process under the conditions to the theorem quoted. It is the object of the present paper to point out how one may obtain

different limiting processes by certain transformations applied suitably to the sample functions of the space R as defined in the above theorem.

In particular, we confine our attention to one transformation, $y_i(t) = x_i(t) - t x_i(1)$ and $y(t) = x(t) - tx(1)$ and show how this transformation carries the Wiener process into another process we call the D -process. Furthermore, we show that under this transformation, measure on the two processes are so related that with the proper adaptation one can get a new class of probability limit theorems with the D -process as limiting process. It is this idea, essentially, that could conceivably be exploited to generate limit theorems having very general types of limiting processes.

Although the limit theorem obtained in the above manner is of theoretical interest, explicit calculation of limiting distributions would depend on a knowledge of the behavior of the limiting processes. In the case we deal with (and this is one of the motivating factors for considering it) a re-application of the principle of transformations on limit theorems as sketched above changes the limit theorem to one with the Wiener process on $[0, \infty]$ as limiting process. (This transformation and the related property in connection with the D -process was first discussed by Doob.) Our limit theorem, modified in this manner, has the following form:

Theorem 4 Let $x_1, x_2, \dots, R, C, S_n$ and $x_i(t)$ be as before, and let $y_i(t) = x_i(t) - t x_i(1)$ and $y(t) = x(t) - tx(1)$. Let F be continuous in the uniform topology on C . Then

$$\lim_{n \rightarrow \infty} P \left[F \left\{ x_n(\cdot) - (\cdot) x_n(1) \right\} \leq \alpha \right] = P \left[F \left\{ [1-(\cdot)] y \left[\frac{(\cdot)}{1-(\cdot)} \right] \leq \alpha \right\} \right]$$

for continuity points of the function of α on the right.

We show that a result of Feller's can be obtained as a special case of the theorem 4, by choosing $F(x) = \max x(t) - \min x(t)$.

Microfilm copy of complete manuscript of 53 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-756.

GROUP EXTENSIONS BY LEFT LOOPS

(Publication No. 7195)

James Harold McKay, Ph. D.
University of Washington, 1953

If a group F is a subgroup of a multiplicative group G and R is a set of representatives for the right cosets of F in G such that R contains the identity of G as the representative of the coset F , then we define representative multiplication in R by assigning to every pair a, b in R the element $a \diamond b$ in R which is the representative of the coset of F in G that contains their product ab . The set R with respect to representative multiplication is a left loop, i.e., R contains a two sided identity for the binary operation \diamond , and the equation $x \diamond a = b$ has a unique solution x in R for every pair a, b in R .

The problem considered in this paper is the following: Given a group F and a left loop R , find all groups G such that G contains F as a subgroup and such that there is some set R' of representatives for the right cosets of F in G which, with respect to representative multiplication, is isomorphic to R . Any such group G is called an extension of F by R .

Necessary and sufficient conditions are given for the existence of an extension of F by R . It is shown that these conditions reduce to the conditions given by Schreier in the case that F is normal in the extension. We also give necessary and sufficient conditions for the existence of an extension of F by R where both F and R are groups.

An extension G of F by R is called a normal extension if F is normal in G , and is called a simple extension if the only subgroup of F which is normal in G is the identity subgroup. By using the fact that any extension G of F by R is homomorphic to a transitive permutation group on the elements of R such that the kernel of the homomorphism is the largest subgroup of F which is normal in G , we obtain a separation of the extension procedure into two parts. One part consists in the construction of a simple extension while the other part requires the construction of a normal extension.

Necessary and sufficient conditions for the existence of a simple extension of F by R are given and we study simple extensions by using the close connection between simple extensions and groups which can be written as transitive permutation groups. In particular we show that for any left loop R , the group $S(R)$ of all permutations on the elements of R is a simple extension of $S_e(R)$ by R , where $S_e(R)$ is the set of all permutations in $S(R)$ which leave the identity of R fixed.

We define two left loops R and R' to be equivalent if the permutation group $T(R)$ which is generated by the right translations of R is equivalent to the corresponding permutation group $T(R')$. On the basis of this definition we can prove that every extension of F by R is an extension of F by R' and vice-versa if and only if R and R' are equivalent. We further exhibit that there is a one-to-one correspondence between classes of equivalent left loops of finite order n and transitive permutation groups of degree n .

Microfilm copy of complete manuscript of 71 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-757.

ON THE VIBRATIONS OF TRIANGULAR MEMBRANES

(Publication No. 7501)

Grove Crawford Nooney, Ph. D.
Stanford University, 1954

The author considers the partial differential equation $\Delta u + \lambda u = 0$ with the boundary condition (i) $u = 0$ or (ii) $\frac{\partial u}{\partial n} = 0$. By means of Fourier series,

complete solutions are derived for the three "exceptional" triangles, the $45^\circ-45^\circ-90^\circ$ triangle, the $60^\circ-60^\circ-60^\circ$ triangle and the $30^\circ-60^\circ-90^\circ$ triangle. In each of these cases, the eigenfunctions are trigonometric polynomials, and it is shown that for no other polygonal domain, except the rectangle, can the eigenfunctions assume a form of comparable simplicity. The complete systems of eigenfunctions and eigenvalues are used to compute the torsional rigidity of a homogeneous beam, the cross-section of which is a $60^\circ-60^\circ-60^\circ$ triangle or a $30^\circ-60^\circ-90^\circ$ triangle. In addition, the following inequality, conjectured by Professor Pólya for an arbitrary domain, is verified for the three exceptional triangles: $A\lambda_n > 4n\pi > A\mu_n$, $n = 1, 2, 3, \dots$. In each case, A is the area of the domain, λ_n is the n -th eigenvalue corresponding to the boundary condition (i) when those eigenvalues are ordered according to magnitude, each in its proper multiplicity, and μ_n is defined similarly with the boundary condition (ii).

On the basis of the results obtained for the exceptional triangles, the lower eigenvalues of arbitrary triangles are estimated using the well-known minimum characterization of the eigenvalues. By combining a theorem of G. Pólya and M. Schiffer on the convexity of the eigenvalues as functions of a certain stretching parameter, the technique of transplantation developed by Pólya and a minimum property of the λ_1 of the equilateral triangle obtained by Pólya and Szegő through symmetrization, upper and lower bounds are found for the λ_1 and μ_2 of isosceles triangles and right triangles. The estimates so obtained are displayed in figures and tables and are reasonably sharp. Simultaneous upper bounds for the λ_1 , λ_2 and λ_3 of right triangles and of completely arbitrary triangles are obtained by using a theorem of Poincaré in connection with transplantation of several eigenfunctions of the exceptional triangles. Again tables indicate the degree of approximation attained.

Microfilm copy of complete manuscript of 85 pages, \$1.06. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-758.

ON A SPECIAL SYSTEM OF
ORTHOGONAL POLYNOMIALS

(Publication No. 7502)

Albert B. J. Novikoff, Ph. D.
Stanford University, 1954

The polynomials $R_n(x) = R_n(x; a, b)$ which are discussed, are defined by

$$R_n(\cos \theta; a, b) z^n = (1 - ze^{i\theta})^{\frac{1}{2}} + i\phi(\theta) \\ (1 - ze^{-i\theta})^{\frac{1}{2}} - i\phi(\theta)$$

where $\phi(\theta) = \frac{a \cos \theta + b}{2 \sin \theta}$, $x = \cos \theta$, $a > \pm b$.

These polynomials, introduced by F. Pollaczek in 1949, are orthogonal in the interval $-1 < x < 1$, with respect to the weight function

$$w(\cos \theta; a, b) = \frac{e^{(2\theta - \pi)\phi(\theta)}}{\cosh [\pi \phi(\theta)]}$$

It is seen that $\{R_n(x; a, b)\}$ furnish a generalization of the Legendre polynomials $P_n(x)$, to which they reduce if $a = b = 0$, but that their general behavior for large n , in particular the location of their zeros, is quite unlike that of this special case.

In § 1-3 general notation and three integral representations for $R_n(\cos \theta)$ are established:

$$(1) R_n(\cos \theta) = \pi^{-1} e^{-2\theta \phi(\theta)} \cosh [\pi \phi(\theta)]$$

$$\int_{-1}^{+1} \exp(i\phi(\theta) \log \frac{1+\alpha}{1-\alpha})$$

$$(\cos \theta + i\alpha \sin \theta)^{-n-1} \cdot (1 - \alpha^2)^{-\frac{1}{2}} d\alpha, \\ (2) R_n(\cos \theta) = \frac{2}{\pi} e^{-\theta \phi(\theta)} \cosh [\pi \phi(\theta)] \int_0^\theta \\ \cos \left\{ (n + \frac{1}{2})t - \phi(\theta) \log \frac{\sin(\frac{\theta+t}{2})}{\sin(\frac{\theta-t}{2})} \right\} (2 \cos t - 2 \cos \theta)^{\frac{1}{2}} dt,$$

$$(3) R_n(\cos \theta) = \frac{2}{\pi} e^{(\pi - \theta)\phi(\theta)} \cosh [\pi \phi(\theta)] \\ \int_0^\pi \sin \left\{ (n + \frac{1}{2})t - \phi(\theta) \log \frac{\sin(\frac{\theta+t}{2})}{\sin(\frac{\theta-t}{2})} \right\} \\ (2 \cos \theta - 2 \cos t)^{-\frac{1}{2}} dt.$$

These are the analogs of the first Laplace and the two Dirichlet-Mehler integral representations of $P_n(x)$, to which they reduce if $a = b$.

In § 4-6 the method of steepest descent is applied to (1) above, to estimate $R_n(\cos n^{-\frac{1}{2}}t)$, and it is shown that

$$(4) \pi e^{(a+b)(\frac{1}{2} - \pi \sqrt{n/2t})} R_n(\cos t / \sqrt{n}) =$$

$$\cos \left\{ \frac{\pi}{4} - \sqrt{n} (\alpha_1 t - \frac{a+b}{2t} \log \frac{1+\alpha_1}{1-\alpha_1}) \right\} \\ (t^2 - (a+b))^{1/4}$$

$$\frac{1}{n^{1/4}} + O(\frac{1}{\sqrt{n}})$$

$$\sqrt{a+b} < t_1 \leq t \leq t_2, \quad \alpha_1 = \frac{t^2 - (a+b)}{t}$$

$$(5) 2 \pi e^{(a+b)(\frac{1}{2} - \frac{\pi \sqrt{n}}{2t})} R_n(\cos \frac{t}{\sqrt{n}}) = \\ e^{\sqrt{n} \left\{ a_1 t - \frac{a+b}{t} \arctan a_1 \right\}} \frac{1}{n^{1/4}} (1 + O(\frac{1}{n^{1/4}}))$$

$$0 < t_1 \leq t \leq t_2 < \sqrt{a+b},$$

$$a = \frac{(a+b) - t^2}{t}$$

where, in each case, the O-term is uniform for t in the indicated interval.

In § 7 with the aid of (4) and (5) above, plus an additional lemma, the following theorem is established: If $x_1(n; a, b)$, $x_2(n; a, b)$, ..., $x_n(n; a, b)$ denote the zeros of $R_n(x; a, b)$, $x_1 > x_2 > x_3 > \dots$, and $x_\nu = \cos \theta_\nu$, $\theta_\nu = \theta_\nu(n; a, b)$, then for fixed ν , $\nu = 1, 2, 3, \dots$,

$$\lim_{n \rightarrow \infty} \sqrt{n} \theta_\nu = \sqrt{a+b}.$$

Microfilm copy of complete manuscript of 47 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-759.

AN APPLICATION OF THE SCHIFFER
VARIATION TO THE FREE BOUNDARY
PROBLEMS OF HYDRODYNAMICS

(Publication No. 7499)

Edward Blake McLeod, Jr., Ph. D.
Stanford University, 1954

In many free boundary problems which occur in hydrodynamics the free boundary assumes such a shape as to make the virtual mass of the fluid stationary. Because of this principle it is possible to formulate many free boundary problems as variational problems. The logarithmic capacity, γ , associated with a domain D is a functional closely related to the virtual mass of a vortex flow in D . Extremum problems which involve this quantity have hydrodynamic analogues.

Such extremum problems can be treated heuristically by a method of comparison devised by Hadamard. Letting C represent the boundary of a domain D , and letting C^* represent the boundary of a domain of comparison D^* , we define the vector position \vec{r}^* of a point z^* on C^* , corresponding to a point z^*

on C^* , corresponding to a point z on C by the formula

$$\vec{r}^* = \vec{r} + \epsilon \rho(z) \vec{n},$$

where ρ is an arbitrary real function of $z \in C$, \vec{n} is the unit vector in the direction of the normal to C at z , and ϵ is an arbitrary real parameter. Using this variation of Hadamard, we may show that the curve which maximizes the logarithmic capacity within a family of curves, all having a constant length, is a circle.

A more rigorous method which was later devised by M. Schiffer allows the class of admissible domains to have more general boundaries. A point z^* in D^* is defined by

$$z^* = z + \frac{\epsilon e^{i\phi}}{z - z_0},$$

where ϕ is an arbitrary member of $[0, 2\pi)$, and z_0 is an arbitrary fixed point in D . In order to treat problems with constraints we may use a more general Schiffer variation of the form

$$z^* = z + \sum_{i=0}^{\infty} \epsilon_i F_i(z, \bar{z}),$$

where each ϵ_i is an arbitrary real parameter and each F_i is an arbitrary complex function of z and \bar{z} . Having established the existence of a solution, we may use the Schiffer variation to solve the following extremum problem.

Find, within the family of rectifiable, continuous, closed curves C^* , all having a logarithmic capacity γ , and such that a fixed linear segment is contained in the complement of D^* , the curve C , which solves the problem

$$\ell(L^*) = \text{Min}$$

Here the letter refers to that part of C , called the free boundary, which is complementary to the fixed segment; $\ell(L)$ is the length of L . The variation of Schiffer and some methods in conformal mapping are important instruments in obtaining the explicit solution of the problem.

We let

$$w = z + \frac{\alpha}{z} \dots,$$

represent the complex velocity potential for a flow in a region D , and we set $a = \text{Re } \alpha$; then the following minimum problem is equivalent to the problem of determining the flow about a bubble having surface tension and certain particular internal compensating pressure forces.

Find, within the family of closed, rectifiable curves C^* , such that the region D^* associated with each of these curves is mapped onto the unit circle by a transformation.

$$\zeta = z + \frac{b_1^*}{z} + \frac{b_2^*}{z} \dots,$$

the curve C , for which there is a minimum value for the functional ℓ^*/A^* .

By methods conceived by M. Schiffer and P. R. Garabedian we obtain the following explicit relation which maps the exterior of the unit circle in the ζ -plane onto the external domain in the z -plane:

$$z = \zeta - \frac{2}{3\zeta} - \frac{1}{27\zeta^3}.$$

Microfilm copy of complete manuscript of 87 pages, \$1.09. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-760.

PHARMACOLOGY

RENAL HEMODYNAMICS AS INFLUENCED BY HISTAMINE

(Publication No. 7079)

William Peter Blackmore, Ph. D.
University of Illinois,
Chicago Professional Colleges, 1953

The effect of histamine on renal hemodynamics was determined in trained, unanesthetized female dogs. The experimental design consisted of 8 fifteen-minute clearance periods grouped in pairs, allowing an interval of one-half hour between each pair of periods. The effect of histamine on glomerular filtration rate and renal plasma flow was ascertained by the technics of inulin and p-aminohippuric acid clearances. The effective renal blood flow was determined from the effective renal plasma flow by means of the hematocrit taken for each sam-

ple. The filtration fraction was calculated as the ratio of the glomerular filtration rate to effective renal plasma flow. Continuous blood pressure readings were taken by means of a recording apparatus devised in this laboratory. Control experiments were conducted on all animals before administration of histamine. Histamine in doses of 2.5 micrograms per kgm. of body weight per minute was administered by constant intravenous infusion for two hours. In the histamine experiments two control periods were taken to infusion and two periods following cessation of histamine. The effects of epinephrine and pyribenzamine on renal hemodynamics as influenced by histamine were studied to determine if the actions of histamine could be antagonized or blocked. Epinephrine was infused continuously in doses of 5 micrograms per kgm. of body weight per minute. Pyribenzamine was administered by single injection in total doses of 2 mgm. per kgm.

of body weight. In addition, the effect of histamine on serum sodium and potassium and rate of urinary excretion of these electrolytes as well as glucose TM was determined.

All animals receiving histamine demonstrated the usual reactions of salivation, flushing, defecation and occasional vomiting. During infusion of histamine the blood pressure decreased 30-40 mm. Hg below control values, but returned to normal following cessation of histamine. A statistically significant increase in renal blood flow was noted in each dog that received histamine. During the recovery period the renal blood flow was still significantly elevated. The glomerular filtration rate remained within control values during infusion, but was significantly increased following cessation of histamine. From these results it seems that the renal action of histamine is that of vasodilatation, affecting both the afferent and efferent arterioles to the same degree, thus decreasing the vascular resistance within the kidney. As a result, the renal blood flow was increased while maintaining a relatively constant glomerular filtration rate and a decreased filtration fraction. The slight, though significant, increase in glomerular filtration rate noted after cessation of histamine infusion might be explained on the basis of a return to normal of the systemic blood pressure and arteriolar tonus in spite of a still elevated renal blood flow. The elevated renal blood flow following cessation of histamine suggested that the kidney may fix histamine from the circulation and thus account for its prolonged action. In all experiments the urine flow was markedly decreased during histamine infusion. The antidiuretic response of histamine, the mechanism of which is still unknown, may be related to the antidiuretic principle of the posterior pituitary since the glomerular filtration rate did not change during infusion.

The effect of histamine on renal hemodynamics was completely antagonized during the recovery period and histamine infusion period when epinephrine was administered. However, the antidiuretic effect of histamine was not antagonized. Administration of pyribenzamine prior to histamine infusion resulted in blocking the effects of histamine on glomerular filtration and renal blood flow for only one hour. The side reactions and depressor response to histamine were blocked throughout the experiments. A second dose of pyribenzamine administered at the end of the first hour of histamine infusion produced no further blocking action. In every experiment pyribenzamine failed to block the antidiuretic response of histamine. Serum sodium and rate of urinary sodium excretion were not influenced by histamine. However, serum potassium was decreased during histamine infusion and the rate of urinary potassium excretion was increased. No changes were noted in glucose TM during histamine infusion or following cessation of histamine.

Microfilm copy of complete manuscript of 120 pages, \$1.50. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-761.

THE ROLES OF TITANIUM DIOXIDE, BENTONITE AND SODIUM CARBOXYMETHYLCELLULOSE IN THE RADIOGRAPHY OF THE GASTROINTESTINAL TRACT

(Publication No. 7081)

Charles Boyd Granberg, Ph. D.
University of Illinois,
Chicago Professional Colleges, 1953

This investigation was designed to study radiologic contrast media, with particular reference to barium sulfate, titanium dioxide, bentonite, and sodium carboxymethylcellulose, in an attempt to develop a new or improved radio-opaque suspension suitable for the more complete coating of the mucosal lining of the gastrointestinal tract, thereby increasing the percentage of diagnostic accuracy by the radiography of the digestive tract.

This research was divided into 2 major parts:

- (1) the preparation of the radio-opaque suspensions;
- (2) the roentgenological screening of the suspensions.

The suspensions prepared were observed and evaluated by determining the pH, specific gravity, opacity (density), taste, storage qualities, viscosity, and suspensive properties.

The radio-opaque suspensions were first screened by radiographic investigations in dogs. A series of upper gastrointestinal studies and a series of opaque enema studies in trained, unanesthetized dogs were completed.

From both the pharmaceutical and roentgenological point of view, the following formula presented definite advantages over the control barium-water suspension:

Barium Sulfate	93.75 Gm.	18.75%
Titanium Dioxide	7.50 Gm.	1.50%
Bentonite (Volclay BC)	5.00 Gm.	1.00%
Glycerin	7.50 cc.	1.50%
CMC-LV*	1.25 Gm.	0.25%
Distilled Water, q. s., ad	500.00 cc.	

*CMC-LV --- Carboxymethylcellulose, Low Viscosity

The preparation is a smooth liquid, radio-opaque suspension, viscid and tenacious enough to hold the barium sulfate in relatively even suspension so that a small quantity will adhere to the walls of the gastrointestinal tract, yet fluid enough to fill the spaces and recesses homogeneously. It does not precipitate in the juices of the alimentary tract; has no apparent deleterious systemic effect; is palatable and agreeable to the patient, producing no complicating physio effect.

The ability of the suspension to adhere to the walls of the gastrointestinal tract is evidenced by X-ray films of this part of the anatomy of both dogs and humans. In dogs, the meal spread thinly enough throughout the small bowel so that in certain films nearly the entire mucosal surface of this structure was readily discernible. Clinically, the suspension left a good coating of the gastric rugae as it emptied from the stomach. The meal was rapidly evacuated

through the pylorus and spread through the small bowel, clearly delineating the intestinal mucosa. The clinical studies of this research have emphasized the point that the suspensions prepared from this formula are more successfully employed as meals than as enemas. This fact corroborates the opinion of several investigators that a single opaque medium may not be satisfactory for both types of gastrointestinal X-ray examination.

Microfilm copy of complete manuscript of 99 pages, \$1.24. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-762.

**THE LINGUOMANDIBULAR REFLEX,
A NEUROPHYSIOLOGICAL AND
NEUROPHARMACOLOGICAL STUDY**

(Publication No. 7084)

Ellen Eva King, Ph. D.
University of Illinois,
Chicago Professional Colleges, 1953

On the basis of physiological studies of the linguomandibular reflex, a method has been devised for the study of the levels of the neuraxis at which drugs act and of the differential sensitivity of interneurons to certain compounds.

The medial, dorsal region of the bulbar reticular formation has been shown to facilitate the linguomandibular reflex; simultaneous inhibition of the patellar reflex indicated the region stimulated to be that described by Magoun as generally inhibitory to reflex and cortically-evoked motor activity. Stimulation of areas projecting to the bulbar reticular formation, the caudate nucleus and the pericruciate gyrus, caused similar effects. Conversely, the rostral regions of the brain stem from pons to diencephalon have been shown to inhibit the linguomandibular reflex; simultaneous facilitation of the patellar reflex indicated the region stimulated to be that described by Magoun as generally facilitatory to reflex and cortically-induced motor activity.

The polysynaptic linguomandibular reflex was very sensitive to the depressant action of mephensin, 6-methyl-2-aminobenzothiazole and atrolactamide. Polysynaptic motor pathways altering reflex activity were depressed by mephensin and 6-methyl-2-aminobenzothiazole both at brain stem and spinal levels while monosynaptic arcs were totally resistant to the compounds. Atrolactamide similarly depressed pathways containing interneurons selectively, but those originating at the level of the caudate nucleus were more sensitive to the drug than pathways originating at pontine, bulbar or spinal levels. No differences between the d, the l and the racemic compound could be observed.

Epinephrine depressed reflex activity and the influence of extrapyramidal motor pathways. This effect could be reduced by adrenergic blockade. Acetylcholine enhanced reflex activity and the extrapyramidal influences on reflexes. The effect was

increased by eserine and partially depressed by atropine. Since both mono and polysynaptic circuits are affected by acetylcholine and epinephrine, it is suggested that these compounds exert their effects at central nervous system synapses.

Microfilm copy of complete manuscript of 159 pages, \$1.99. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-763.

**A PHARMACOGNOSTICAL INVESTIGATION
OF CHENOPODIUM BOTRYS L.
AND RELATED SPECIES**

(Publication No. 7245)

Robert Meyer Leonard, Ph. D.
University of Minnesota, 1953

The principal species of *Chenopodium* which have been investigated for possible economic uses are reviewed. Some of the difficulties encountered in evaluating the reports in the literature and problems for future investigations are discussed. The taxonomy, synonymy, and history of *Chenopodium album* L., *C. ambrosioides* L. var. *anthelminticum* (L.) Gray, *C. Botrys* L., and *C. gigantospermum* Aellen (*C. hybridum* of Europe) are presented. The early literature (18th and 19th centuries) describes numerous empirical uses for *C. Botrys*, but there are no subsequent reports to prove or disprove the basis for these uses and to give reasons for the eventual abandonment of the medicinal plant.

C. Botrys was successfully grown in the University of Minnesota Medicinal Plant Garden for the pharmacognostical investigation. In addition, cultivated plants of *C. ambrosioides* var. *anthelminticum* and wild plants of *C. album* and *C. gigantospermum* were used for comparative purposes.

The characteristic trichomes of the four species of *Chenopodium* are described from their primordia through maturity. Camera lucida drawings and photomicrographs are used to supplement the written descriptions.

Brief descriptions are given of the development of the flowers of *C. Botrys*, and of the morphology and histology of the roots, stems, and leaves of the four species. Numerous photomicrographs and camera lucida drawings are used in place of the lengthy written descriptions to illustrate the histological sections of the plants.

The cultivation, harvesting, and distillation of the plants of *C. Botrys* are discussed.

The physical properties and a limited number of chemical tests are described for the steam-distilled, chloroform-extracted oil of *C. Botrys*. The results of similar tests carried out on a commercial sample of U.S.P. XIII *Chenopodium* Oil are included for comparison.

Experiments performed on various species of animals to determine the pharmacological properties of *C. Botrys* oil are described. Acute toxicity studies, to determine the approximate LD₅₀s (intraperitoneal

administration to albino mice) of C. Botrys oil and U.S.P. XII Chenopodium Oil, are reported.

The results of the entire investigation are summarized and discussed.

Microfilm copy of complete manuscript of 169 pages, \$2.11. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-764.

INFLUENCE OF ALCOHOL ON THE DISTRIBUTION OF BARBITURATES IN MAMMALIAN TISSUE

(Publication No. 7085)

Komol Pengsritong, Ph. D.
University of Illinois,
Chicago Professional Colleges, 1953

The joint use of barbiturate and alcohol has become widespread recently, and cases of fatal barbiturate poisoning have been frequently reported following the administration of the combination at dosage levels not ordinarily considered toxic. This work was therefore dedicated to the study of the synergistic influence of alcohol upon the distribution of the barbiturate in the mammalian tissue.

Barbital, phenobarbital, and pentobarbital were injected subcutaneously into albino rats, either with or without oral administration of alcohol. It was found that the duration of sleep of the animals under either one of the barbiturate is much prolonged, while the time of respiratory failure is markedly shortened, when both the barbiturate and the alcohol have been administered.

Samples of blood and other tissues taken at the time of respiratory failure were analyzed for their barbiturate contents by a spectrophotometric method developed in conjunction with this problem in this laboratory. It consists briefly of extracting the acidified tissue in a micro-Waring blender with chloroform (except the brain, in which ethylene dichloride is used). The barbiturate in the organic solvent is then returned to a pH 11 borate buffer solution, which is read at 239 m μ . (or 240 m μ ., depending upon the exact peak of absorption of the barbiturate used) and at 295 m μ ., at which the barbiturate shows practically no absorption at all. The difference between the two readings is used in the calculation of the barbiturate concentration against the one obtained from the similarly treated standard solution.

It was observed that the concentrations of the barbiturate in the brain are not significantly different in the two groups of animals. Alcohol was also found not to increase the rate of penetration of the barbiturates into the brain, and the death of animals in the barbiturate group occurs long after the brain has acquired the lethal level of the barbiturate. It is therefore suggested that alcohol potentiates the toxic action of the barbiturate through its histotoxic action on the brain, probably by depriving the latter of the available oxygen needed for the cell respiration.

Alcohol does not change the ordinary pattern of distribution of the barbiturate in the various tissues or organs.

N-allyl-nor-morphine slightly shortens the sleeping time of animals under pentobarbital and alcohol combination, but has no significant effect in those which have received only the barbiturate.

Microfilm copy of complete manuscript of 79 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-765.

THE EFFECTS OF HYPOXIA AND CERTAIN DRUGS UPON THE EXPERIMENTAL PRODUCTION OF BACTERIAL ENDOCARDITIS IN RATS

(Publication No. 7264)

Franklin Ernest Roth, Ph. D.
University of Minnesota, 1953

Bacterial endocarditis was experimentally produced in male and female rats subjected to chronic, discontinuous exposure to an environment of reduced barometric pressure (282-270 mm. Hg., or a simulated altitude of 25,000-26,000 feet with a pO₂ of 59-56 mm. Hg) in a decompression chamber and injected with beta-hemolytic streptococci following thirty days of such exposure. Rats treated in this manner developed a 75-88 per cent incidence of the disease, which was in significant contrast to the 0-20 per cent incidence demonstrated in rats injected with bacteria but not exposed to hypoxia. These results suggested that the susceptibility of the cardiac valves to infection might be due to previous mechanical injury to the valves because of hypoxia exposure and the resultant increased work load imposed on the heart before bacterial injections were started.

Although rats exposed to hypoxia showed evidence of adjustment to this stressful environment by the responses of cardiac ventricular and adrenal cortical hypertrophy, as well as increases in hemoglobin concentration, they were not considered to be fully "acclimatized" because of the increased vulnerability of their cardiac valves to bacterial invasion.

The prophylactic use of penicillin and dihydrostreptomycin in rats exposed to hypoxia and bacterial endocarditis to 11-30 per cent when compared to control animals. Various drugs other than antibiotics were employed in attempts to reduce the incidence of the disease and with the hope that knowledge of their pharmacological actions could further the understanding of the mechanism of cardiac valvular predisposition to endocarditis in this study. Pyribenzamine, Cortisone, and growth hormone administration did not significantly reduce the incidence of the disease. However, Cortisone treatment inhibited adrenal cortical hypertrophy as a response to exposure to hypoxia, and induced atrophy of the adrenal glands in rats injected with bacteria but not exposed to hypoxia. Growth hormone administration prevented the body weight loss usually displayed

rats exposed to hypoxia and bacterial injections.

The administration of the adrenergic blocking drugs, Regitine and Apresoline, and the ganglionic blocking drugs, Bistrium and Esomid (hexamethonium compounds), significantly reduced the incidence of bacterial endocarditis to 15-32 per cent in rats exposed to hypoxia and bacterial injections and compared to control animals. The pharmacological activity of these drugs in their ability to elicit hypotension and antagonize sympathetico-adrenal discharge as a response to hypoxia was discussed in relation to the susceptibility of the cardiac valves to injury and infection in this study.

Severe lesions of the leg joints, diagnosed as characteristic of rheumatoid arthritis, developed in rats which received bacterial injections of beta-hemolytic streptococci that were cultivated in broth with the addition of human blood. The use of this method for the further study of experimental arthritis was also discussed.

Various concentrations of the drugs employed

were prepared and injected in a 15 per cent solution of polyvinylpyrrolidone which acted as a retardant vehicle for the intramuscular absorption of the drugs, as well as to delay the rapid onset and extensive degree of hypotension usually elicited by the adrenergic and ganglionic blocking agents.

An historical background of experimental methods previously utilized for the production of bacterial endocarditis and the exposure of animals to hypoxia was presented.

This investigation has demonstrated the use of an economical method for the production of a consistently high incidence of bacterial endocarditis in rats. The technique and the species of animal employed have proven suitable for the screening of drugs for possible therapeutic value in the treatment of this disease.

Microfilm copy of complete manuscript of 195 pages, \$2.44. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-766.

PHYSICS

PHYSICS, GENERAL

THE HALL EFFECT IN FERROMAGNETICS

(Publication No. 7184)

Frank Joachim Blatt, Ph. D.
University of Washington, 1953

The material in this thesis falls into four main sub-divisions:

1. A survey of the experimental results of the galvanomagnetic, thermoelectric and allied properties of ferromagnetic metals. (Chapters I and II)
2. A discussion of some mechanisms which have been advanced in attempts to find an explanation of the extraordinary Hall effect of ferromagnetics. (Chapter III)
3. An examination of the validity of the solutions of the Boltzmann equation. (Chapter IV)
4. A careful examination of the experimental data in an effort to unravel the dependence of the extraordinary Hall effect on magnetization and temperature. (Chapter V)

Hall effect measurements on the ferromagnetic metals have led to the following expression for the Hall field per unit current density.

$$E_H = R_0 H + R_1 M.$$

Classical and simple quantum mechanical considerations lead to $R_1 = 4\pi R_0$. This result is not changed when one takes into consideration the fact that below the Curie temperature the macroscopic magnetization of a ferromagnetic metal is due to a suitable arrangement of domains, all of which are magnetized to saturation magnetization. Another

result of classical as well as quantum mechanical calculations is that the Hall coefficients R_0 and R_1 are nearly independent of temperature.

In fact, however, R_1 is strongly temperature dependent between low temperatures and the Curie temperature of the sample, and as the Curie temperature of the sample is approached R_1 may become a thousand times as large as R_0 .

Not only the Hall effect but also other transport phenomena exhibit anomalies in the ferromagnetic metals, and a brief survey of these phenomena is presented in Chapter II.

Of the several mechanisms which have been advanced in order to explain the unusual behavior of R_1 , the extraordinary Hall coefficient, one, in particular, is considered in detail in Chapter III. This mechanism concerns the motion of conduction electrons in a magnetic field which has the same spatial periodicity as the electrostatic lattice potential. The calculation, which has also been made by others, indicates that this mechanism is extremely unlikely to serve as an explanation for the extraordinary Hall effect. Also included in this chapter is a short discussion of the mechanism of spin-orbit coupling and a brief mention of anisotropic scattering as sources of the extraordinary Hall effect.

The failure of the analysis of Chapter III to explain the large values and the temperature dependence of the extraordinary Hall coefficient has led us to consider the methods of solution of the Boltzmann equation. A discussion of the pertinent questions is contained in Chapter IV.

In the final chapter the experimental data is subjected to a careful analysis. It is shown that, contrary

to the usual interpretation, the extraordinary Hall coefficient is in all probability a function of the intrinsic magnetization at constant temperature. It is shown that the dependence of R_1 on the intrinsic magnetisation may be of significance even at temperatures well below the Curie temperature, and that, therefore, the values of the ordinary Hall coefficient which have been given in the literature may be in error.

Microfilm copy of complete manuscript of 122 pages, \$1.53. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-767.

PROPAGATION OF A SOUND PULSE IN A MEDIUM WITH A COMPLEX ELASTIC MODULUS

(Publication No. 7168)

Salah Izzat Tahsin, Ph. D.
Michigan State College, 1953

In the first part of this thesis, the physical causality principle along with the assumption that a real (not complex) cause gives rise to a real effect, is used to derive the following properties of the complex propagation constant $k(u)$.

1. It is analytic in the lower half of the complex u -plane.

2. $\lim_{u \rightarrow \infty} k(u) = \frac{u}{c}$ as $u \rightarrow \infty$.

3. Its real and imaginary parts satisfy the Kronig-Kramers relations.

4. It possesses symmetry properties; i. e.,

$$\bar{k}(u) = -k(-\bar{u}).$$

where the bar represents the complex conjugate.

The second part of this thesis discusses the propagation of a plane wave pulse in an infinite, homogeneous, and isotropic medium whose elastic modulus is assumed to be represented by a simple form consistent with the relaxation theory of the elastic moduli.

Since the Fourier integral which occurs in this problem cannot be evaluated exactly, two approximate methods are employed to find the shape of the pulse. The precursors of the pulse are shown to be exponential in form, negative for $\omega_0 \ll \frac{\sqrt{\alpha}}{t}$ and positive for $\omega_0 \gg \frac{\sqrt{\alpha}}{t}$, where (α) is the amplitude of the relaxing part of the modulus and (τ) is the relaxation time.

Microfilm copy of complete manuscript of 52 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-768.

PHYSICS, NUCLEAR

NUCLEON ISOBARS IN INTERMEDIATE COUPLING

(Publication No. 7190)

Francis Harvey Harlow, Jr., Ph. D.
University of Washington, 1953

The energies of excited states of nucleons are calculated for the symmetric pseudoscalar meson theory with a fixed extended source. A version of the Tomonaga approximation, which is shown to be approximately correct in the limit of strong coupling, is used. The calculation is carried out for moderate coupling by using trial functions with 0, 1, 2, and 3 mesons. Numerical results are presented for a source of the Yukawa shape. For coupling stronger than a critical strength which varies with state and source size, isobars are found for angular momenta $\frac{1}{2}, \frac{3}{2}$ and for isotopic spins $\frac{1}{2}, \frac{3}{2}$. The $(\frac{3}{2}, \frac{3}{2})$ state always lies lowest in energy. A very large source ($\sim \frac{1}{2}$ the meson Compton wave length) yields a $(\frac{3}{2}, \frac{3}{2})$ isobar at $\sim 350 - 400$ Mev excitation, and a degenerate $(\frac{3}{2}, \frac{1}{2})$ and $(\frac{1}{2}, \frac{3}{2})$ pair at ≥ 500 Mev. Other isobars lie considerably higher. Smaller sources correspond to higher excitation energies in this range of coupling strength.

Microfilm copy of complete manuscript of 59 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-769.

THE SECOND-FORBIDDEN BETA-SPECTRA OF Co^{60} AND Sc^{46}

(Publication No. 7192)

Glenn Leroy Keister, Ph. D.
University of Washington, 1953

A hitherto unreported high energy beta-ray component has been found in the decay of Co^{60} . Its abundance and end point are $(0.15 \pm 0.01)\%$ and 1.48 ± 0.02 Mev, respectively. The abundance and end point of the Sc^{46} high energy component are $(0.096 \pm 0.01)\%$ and 1.25 ± 0.02 Mev, respectively. Both the Co^{60} and Sc^{46} spectra can be fitted with the C_{27} correction factor corresponding to $\Delta J = 2$ and no parity change. The log ft values, uncorrected for the forbidden shape, are: $\text{Co}^{60} = 12.6$, and $\text{Sc}^{46} = 11.3$. The decay schemes are discussed.

Microfilm copy of complete manuscript of 67 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-770.

HIGH ENERGY PHENOMENA IN NUCLEAR EMULSIONS

(Publication No. 7253)

John Earl Naugle, Ph. D.
University of Minnesota, 1953

Nuclear emulsions which had been exposed to the cosmic radiation at balloon altitudes have been surveyed for extremely energetic interactions between heavy nuclei of the primary cosmic radiation and nuclei of the emulsion. Four interactions were observed in which the charge of the incident particle was greater than one, and its energy was greater than four hundred bev per nucleon.

The observed variation with energy of the multiplicity of meson production is in agreement with the Fermi theory and also with the recently revised Heisenberg theory of meson production. The observed angular distributions of the mesons are in agreement with the Fermi theory. The observed energies of the mesons are lower than those predicted by the Fermi theory and slightly higher than those predicted by the Heisenberg theory.

In one of the interactions it was possible to study the electromagnetic cascade associated with the interaction. A neutral meson to charged meson ratio of $.5 + .3$ was obtained. The average energy of the neutral mesons was approximately a tenth that of the charged mesons in this interaction. A mean free path of $2.8 + .8$ cm of emulsion was obtained for the direct production of a pair by an electron with energy between two and a hundred bev. This is smaller by at least a factor of two than that predicted by theory.

Microfilm copy of complete manuscript of 119 pages, \$1.49. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-771.

ELASTIC SCATTERING OF ALPHA PARTICLES BY HEAVY NUCLEI

(Publication No. 7207)

Harvey Edward Wegner, Ph. D.
University of Washington, 1953

The energy dependence of the elastic scattering cross section for alpha particles scattered by heavy

nuclei has been measured over the incident energy range 14 - 40 Mev. Measurements were made at a scattering angle of 60 degrees for Ag, Ta, Au, and Th, and at a scattering angle of 90 degrees for Au. 40 Mev alpha particles, accelerated by the University of Washington Cyclotron, were progressively decreased in energy by copper absorbers over the above incident range in energy. The scattered particles were counted with a proportional counter telescope arrangement and the number of incident particles counted with a beam current integrator. The energy of the particles was determined by measuring their range in aluminum.

It was found that the elastic scattering cross section $\sigma(E_\alpha)$ showed a pure Rutherford energy dependence up to a critical energy E'_α above which the dependence could be expressed by the empirical equation $\sigma(E_\alpha) = \sigma(E'_\alpha)e^{-K(E'_\alpha - E_\alpha)}$. For the elements investigated, E'_α increased with the atomic mass A and the nuclear charge eZ_n . However, the exact nature of the dependence is not clear from the available data. The parameter K is nearly independent of A and Z_n and increases with increasing scattering angle ϕ .

A quantum mechanical description of these scattering phenomena was made by Dr. J. S. Blair, assuming a strong absorption model. The physical interpretation of the calculation suggests that the distance of nearest approach, or apsidal distance, corresponding to the energy where the observed cross section is one quarter that of the coulomb cross section, is equal to the sum of the radii of the alpha particle and the target nucleus. The radius of the alpha particle calculated from the experimental data upon the above assumption, and using the expression $R_n = 1.5 \times 10^{-13} A^{1/3}$ for estimating the nuclear radius R_n , is in approximate agreement with theoretical estimates.

This experimental method, upon application to various elements at various scattering angles, may make possible measurements of slight differences in nuclear radii. Using separated isotopes, empirical functional relationships may be found between Z_n , A , ϕ and E , K . Many different measurements of this type may also result in a better estimate of the collision radius of the alpha particle.

Microfilm copy of complete manuscript of 78 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-772.

PHYSIOLOGY

THE EFFECTS OF STRESS, CORTICOTROPIN, CORTISONE AND DESOXYCORTICOSTERONE ON THE QUANTITATIVE HISTOLOGICAL DISTRIBUTION OF ASCORBIC ACID IN THE ADRENAL GLAND OF THE RAT AND THE MONKEY

(Publication No. 7215)

Robert Carlton Bahn, Ph. D.
University of Minnesota, 1953

It is well established that stress conditions cause a rapid diminution in the concentration of adrenal ascorbic acid. Although this change is considered to take place primarily in the adrenal cortex, the role played in this phenomenon by each of the histologic zones is unknown. The purpose of this undertaking is to investigate in the rat and the monkey the following related problems: (1) the quantitative histological distribution of ascorbic acid in normal animals; (2) the effect of stress conditions and the administration of corticotropin desoxycorticosterone and cortisone upon the quantitative histological distribution of adrenal ascorbic acid. The stress conditions imposed on the rat included chilling, inhalation of ether and violent struggling. Monkeys were subjected to combined hypoxia and hyperthermia and some of them were found to have granulomatous lesions which in themselves appeared to produce a state of stress.

A cylinder of tissue was punched out perpendicular to the flat surface of the frozen fresh adrenal gland and microtome sections were cut parallel to the surface of the gland with a Minot-rotary microtome in a constant-temperature (-20°C .) cryostat. Alternate sections were fixed in Carnoy's solution and later stained with toluidine blue. Ascorbic acid was extracted from the intervening sections with aqueous oxalic acid. An excess of 2,6 dichlorophenol-indophenol was then added, the residual dye extracted with N-amyl alcohol and the optical density of the organic phase determined in the microscope photometer. In some experiments analyses for the sum of dehydro-ascorbic and diketogulonic acids was done on the aqueous phase by the synthesis and measurement of the phenylhydrazone of 2,4 dinitrophenylhydrazine. For each animal the ascorbic acid concentrations which were measured were plotted as a function of the distance of the samples from the gland's surface and these results were correlated with the histological information obtained from the stained sections. From these individual curves a composite curve was constructed for each state or treatment.

It was found that although the concentration of ascorbic acid was 4-5 times greater in the gland of the normal rat than it was in the normal monkey, the same qualitative distribution was present in both.

The highest concentration of ascorbic acid were demonstrated in the outer fascicular and reticular zones. Only very small concentrations of dehydro-ascorbic and diketogulonic acids were found in any of the histologic regions in the adrenal of the normal rat.

There was a decrease in the concentration of adrenal ascorbic acid of rats subjected to violent struggling, ether anesthesia, or exposure to cold (2°C .). This decrease took place primarily in the outer portion of the zona fasciculata and in the zona reticularis. Ascorbic acid depletion was detected within 2-10 minutes following subjection of rats subjected to ether inhalation or violent struggling. In rats exposed to cold (2°C .) for one hour or forced to struggle violently no accumulation of dehydro-ascorbic and diketogulonic acids was detected in the adrenal.

A decrease in the concentration of ascorbic acid occurred of monkeys dying with pulmonary granulomas or those killed by hypoxia and hyperthermia. This decrease took place primarily in the outer portion of the fasciculata and in the reticularis. In one ascorbic acid deficient monkey the depletion of this vitamin from the adrenal cortex was apparent in all zones.

The alterations of adrenal ascorbic acid of both rats and monkeys one hour after an intraperitoneal injection of corticotropin (15-30 mg./kg. body weight) was qualitatively similar to that produced by stress conditions.

In rats receiving daily subcutaneous steroid hormone injections (7 mg./kg. body weight) for approximately three weeks, desoxycorticosterone did not cause a significant change in the ascorbic acid concentration in any of the adrenal zones. Cortisone brought about a decrease in the concentration of ascorbic acid in both the outer fasciculata and the reticularis.

Microfilm copy of complete manuscript of 64 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-773.

STUDIES ON THE ELECTROARCHITECTONICS OF THE CEREBRAL CORTEX

(Publication No. 7219)

Nathaniel Avrom Buchwald, Ph.D.
University of Minnesota, 1953

Electroarchitectonic maps were prepared of cortical potentials recorded by a penetrating microelectrode from a series of stations beneath the cortical surface. These potentials were evoked by electrical stimulation of the sciatic nerve complex

or the dorsal funiculus of the spinal cord and were recorded from the somesthetic area of the cat brain. In general appearance the above maps were similar to those made by recording cortical potentials evoked by auditory stimuli. The surface cortical potential evoked by somesthetic stimulation was a biphasic wave. The first phase of this potential, a surface positivity, could be analyzed into two components, a non-labile early positivity which was attributed to axonal impulses travelling to the cortex and a labile "major" positivity which reversed to a negativity when the recording electrode penetrated the cortical surface to a depth of 1 plus millimeters. The latency of the surface somesthetic potential was decreased with increasing stimulus intensity. Antidromic volleys into the lateral corticospinal tract or the medullary pyramids evoked a brief positive-negative surface potential. This potential did not change form when recorded by a penetrating microelectrode from stations beneath the cortical surface. Because of this, antidromic maps could not be prepared from it. The antidromic cortical potential, as reported by Woolsey and Chang (1948), could be recorded from the entire somatic receiving area of the cat cerebral cortex as well as from the precruciate "motor" area. This potential did not decrease in latency when the stimulus intensity was raised. This potential was refractory to topical dialization and could be recorded from the white matter when the cortical gray was ablated. Although the antidromic and somesthetic potentials could both be recorded from the same loci in the postcruciate cortex, they could be differentiated by the shorter latency of the antidromic potential. It was concluded, despite contrary opinions in the literature, that the antidromic cortical potential does not propagate into cortical pyramidal cells.

Microfilm copy of complete manuscript of 76 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-774.

HEPATIC CATALASE IN RELATION TO TRANSPLANTABLE TUMORS IN RATS

(Publication No. 7082)

Lester Edward Grubgeld, Ph. D.
University of Illinois,
Chicago Professional Colleges, 1953

Possible sources of error in the determination and calculation of liver catalase activity have been studied.

The presence of a Walker tumor in the rat causes an enlargement of the liver which is associated with a decrease in the concentration and total amount of catalase activity. Thus, the decrease in concentration of catalase was not due to the enlargement of the liver or to dilution as a result of the enlargement; it was an absolute and not just a relative decrease.

It was found that enforced fasting for 24 or 48

hours which is known to decrease the size of the liver decreased significantly the concentration and total amount of catalase activity in the liver of a rat. The observation that food intake or inanition influences liver catalase activity has to be taken into consideration in the interpretation of the results of various authors in the literature and in the design of experiments for the study of hepatic catalase activity.

Since the presence of a malignant tumor, especially when it is large, may serve to cause stress in the animal on the basis of the concept of Selye, the effect of some drugs (subcutaneously injected formalin and adrenalin) and a procedure (swimming to exhaustion) used generally to produce stress on liver catalase activity was studied. It was found that these factors decrease liver catalase activity and that a decrease in food intake must be considered in the interpretation of the results.

Using the Warburg apparatus, it was found that the decrease in liver catalase activity was not associated with a change in the respiratory activity of slices of liver, thymus, spleen and adrenals taken from rats of either sex sacrificed at intervals up to 15 days following the transplantation of the Walker tumor, as compared with tissues taken from control non-tumor-bearing rats.

It is possible that liver catalase activity is decreased in a tumor-bearing animal as the result of the production of a "toxohormone" by the tumor. This was studied by fractionating Walker tumor and rat skeletal muscle by recognized chemical procedures. Various amounts of the extracts were injected into rats, using ad libitum fed and fasting rats injected with physiological saline solution, and ad libitum fed rats injected with crystalline egg albumin and amigen (protein digest) as controls. The injection of the control material did not significantly decrease liver catalase activity. The extracts of Walker tumor and skeletal muscle reduced liver catalase beyond that due to fasting but both extracts reduced the catalase activity to the same extent. So, this evidence does not indicate that liver catalase is reduced by a "toxohormone" produced by the tumor. If so, it was not present in the extracts used.

The extracts of Walker tumor and of skeletal muscle had no significant effect on the respiration of slices of liver when the animals providing the slices were pretreated with the extracts or when the extracts were placed in direct contact with slices of liver, spleen or Walker tumor.

When male rats were injected with diethylstilbestrol a significant decrease in liver catalase activity was noted.

It is clear from the results of these studies that a reduction in liver catalase is not specific for the presence of a malignant tumor, such as the Walker tumor, in a rat.

Microfilm copy of complete manuscript of 92 pages, \$1.15. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-775.

THE CONTRACTILE ACTIVITY OF THE
PREGNANT HUMAN UTERUS PRIOR TO LABOR
A STUDY WITH THE REYNOLDS
TOKODYNAMOMETER

(Publication No. 7240)

Irwin Herbert Kaiser, Ph. D.
University of Minnesota, 1953

The contractile activity of the pregnant human uterus from the 19th week to term, but prior to labor, has been studied with the Reynolds multiple channel tokodynamometer. The TKD is an externally applied semiquantitative recorder which permits observation of two or more areas of the anterior uterine wall simultaneously.

Four-hundred and ninety-four two-hour records, obtained on 277 women, are the basis of conclusions concerning Braxton Hicks activity. Evidence that these patients are a satisfactory sample of a normal Caucasian obstetrical group is submitted. The series is weighted with primiparas but there is no evidence that their Braxton Hicks activity differs materially from that of multiparas. Either a placebo or pyribenzamine was given to the patients prior to 216 of these TKGs. Fewer contractions were observed in this group than in groups in which no medication was given.

Major contractile activity occurs in 91% of all records. The incidence of records with contractions does not change much as pregnancy advances. The median number of contractions in the fundus in two hours rises from 3.4 at 27-28 weeks to 9.6 at 37-38 weeks, in the lower uterus from 2.6 to 6.2 at 39-40 weeks. There is little change in the median force or duration of the contraction phase. The total duration of contractions tends to increase with advance of pregnancy. Contractions also tend to be more evenly spaced within the two-hour period as pregnancy advances.

Minor contractile activity, which is characterized by much smaller amplitude and far greater frequency than major contractions, is observed in about 34% of all records. The capacity of the TKD to record these contractions is limited, and there is no correlation between their appearance in a TKG and any clinical feature. Their mean frequency is almost exactly one per minute.

There is no evidence of any systematic increase in the coordination of contractions as term approaches. At various stages from 68% to 87% of all records exhibit some contractions simultaneously in the fundus and lower uterus. In general, fundal contractions are more forceful. There is no trend toward an increasing gradient of force as pregnancy advances.

Individual patients tend strongly to exhibit similar patterns of Braxton Hicks activity on repeated observation during pregnancy.

Comparison of pre-labor major contractile activity with duration of labor produces evidence of

relationships too small to apply to individual patients. Those patients who deliver early appear to have more frequent contractions than those who deliver late.

Results of a survey of the effects of adrenalin, pituitrin, ephedrine, neosynephrine, regitine, priscol, ergotamine, prostigmin and methergine in 307 instances are also described.

Microfilm copy of complete manuscript of 135 pages, \$1.69. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-776.

PATHOPHYSIOLOGY OF TRYPSIN,
TRYPSINOGEN, AND TRYPSIN INHIBITOR

(Publication No. 7083)

Martin Howard Kalser, Ph. D.
University of Illinois,
Chicago Professional Colleges, 1953

A trypsin inhibitor was shown to be present in pancreatic juice and a method for the quantitative of this substance in pancreatic juice and pancreatic tissue was developed. The inhibitor of the pancreatic juice has many of the characteristics of the crystalline trypsin inhibitor. Also a substance in the duodenum, presumably enterokinase, apparently destroyed the inhibitor.

In response to both secretin and/or urecholine stimulation the secretion of trypsin inhibitor paralleled the secretion of trypsinogen. However after urecholine stimulation the ratio of inhibitor to trypsinogen was less than it was with secretin stimulation alone. In another group of animals treated with ethionine for seven days, definite microscopic evidence of pancreatitis was found. Pancreatic secretion of this group of animals was characterized by a decreased volume, and decreased output of trypsinogen and trypsin inhibitor. However the secretion of inhibitor was more impaired than the secretion of trypsinogen. Extracts of the pancreatic gland of the ethionine-treated animals showed similar changes in trypsinogen and inhibitor concentration as did the juice of these animals. However the concentration of trypsinogen was higher in the extracts of the animals with pancreatitis. Trypsin was present in pancreatic juice and extracts of normal animals. However trypsin was present more frequently and in greater concentration in the animals treated with ethionine.

Microfilm copy of complete manuscript of 104 pages, \$1.30. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-777.

STUDIES ON THE ABSORPTION OF WATER FROM THE INTESTINE

(Publication No. 7244)

Jui Shuan Lee, Ph. D.
University of Minnesota, 1953

The purpose of the investigation was to obtain new knowledge of the various aspects of the water absorption process in the mammalian intestine.

A high degree of local plasma dilution during rapid water absorption into intestinal capillary blood was inferred from a study of the occurrence of intravascular hemolysis. Hemoglobinemia was found in rats, cats, rabbits and dogs after feeding of water or water lavage of the small intestine. In rats, after feeding a large dose of water (45 ml/Kg), hemoglobinuria frequently occurred. During the early period of water absorption the increase of Hb concentration in portal vein plasma was always greater than that of plasma samples from femoral or carotid artery, renal vein or inferior vena cava. This indicates that the hemolysis takes place majorly in the portal system. The Hb concentration of portal plasma rises to a maximum in 5 to 15 minutes after water feeding and then declines; the Hb concentrations of plasma samples from all the vessels sampled become practically identical within 10 to 15 minutes after water administration. These observations indicate that the duration of rapid hemolysis was limited to the first 5 to 15 minutes.

New evidence is presented to show that the lymphatics may play a more important role in the absorption of water from the intestine than was heretofore thought. After introduction of water or salt solution into the intestine an immediate engorgement of mesenteric lacteals was observed. The mesenteric lacteal lymph flow is greater during absorption of water from distilled water or hypotonic fluids than from isotonic fluids. The specific activity of Na^{22} and K^{42} of lymph during absorption of labeled fluids is equal to or higher than that of plasma, indicating lymphatic absorption of these ions. The D_2O concentration of lymph is far lower than that of the venous plasma during absorption of D_2O -enriched fluid; this may be interpreted as evidence of equilibration between lymph and tissue water during the passage of lymph from the villi.

The water exchange rate between mucosa and blood is significantly lower than that between muscle and blood. One does not find complete equilibrium between blood and gut tissue water after one passage of blood. The evidence is as follows: (1) during continuous intravenous injection of D_2O -saline, the D_2O concentration of mucosa was at all times throughout the injection period much lower than that of the muscle, and both mucosa and muscle concentration were lower than that of venous blood; (2) in perfusion of a loop of dog's small intestine with D_2O -enriched blood, the D_2O concentrations of both mucosa and muscle were significantly lower than that of the venous blood, that of the mucosa being the lowest; and (3) during absorption of D_2O -enriched fluid from gut lumen, the D_2O concentration of

mucosa is 3 to 4 times that of muscle; also, the muscle D_2O content is, in most cases, considerably higher than that of the venous blood.

Microfilm copy of complete manuscript of 85 pages, \$1.06. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-778.

SOME STUDIES ON THE EFFECTS OF HYPOXIA UPON THE RESPIRATION AND CIRCULATION OF NON NARCOTIZED DOGS

(Publication No. 7288)

Gabriel Georges Nahas, Ph. D.
University of Minnesota, 1953

Summary

A. Methods are described for measuring intracardiac pressures and "cardiac output" in the normal, trained, non narcotized dog breathing 8 per cent oxygen in nitrogen (hypoxia).

B. Under such experimental conditions, the following respiratory and circulatory changes were observed:

1. An increase in pulmonary artery pressure amounting to 4-5 mm. Hg and beginning within one minute after onset of hypoxia. This increase in pressure reached a plateau after five minutes and maintained itself at that level during the entire period of hypoxia. Pulmonary artery pressure fell to its control level within one to two minutes after cessation of the low oxygen mixture.
2. No significant change in left atrial pressure.
3. A 34% increase in heart rate.
4. An increase in cardiac output measured five minutes after hypoxia by the dye dilution method and by the pulse contour method. This increase amounted to 56 per cent when calculated by the former method and to 36 per cent by the latter.
5. The increased cardiac output could account for the increased pulmonary artery pressure observed without postulating an increased pulmonary vascular resistance.
6. A significant fall in oxygen uptake measured five minutes after onset of hypoxia, over a five minute period.

C. These effects resembled those produced by small doses of epinephrine. They were reduced when the animals were sympathectomized and were not evident in five dogs whose adrenals had been removed.

Microfilm copy of complete manuscript of 111 pages, \$1.39. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-779.

**SOME EFFECTS OF SPECIFIC DIETARY
ALTERATIONS UPON THE LIFE SPAN
AND THE CAUSES OF DEATH
IN C₃H MALE MICE**

(Publication No. 7258)

Y. Chiung Puh-Lee, Ph. D.
University of Minnesota, 1953

The results of experiments designed to observe life span and the causes of death of C₃H male mice as influenced by a number of variables in a semi-purified diet, such as a quantitative or qualitative change of minerals, fats, carbohydrates or vitamins with special reference to vitamin E and vitamin B₁₂ are reported. The observations appear to indicate that under well controlled conditions the life span of the inbred C₃H strain mice can be modified markedly by the dietary regimen. Life span is directly determined by the age at onset and the frequency of occurrence of various fatal diseases.

Mice on a semi-purified diet containing a modified Jones-Foster salt mixture developed a typical metabolic disorder in old age which terminated in a "heart failure syndrome." The metabolic dysfunction can be delayed and the incidence reduced by caloric restriction alone or by a supplement of vitamin E. Vitamin B₁₂ supplement apparently also delays the onset. The favorable effect of caloric restriction on the heart condition was not due to the effect of low fat or low glucose in the restricted diet. The interrelation of caloric intake, minerals and vitamin E or B₁₂ requirement with respect to the causes of death and longevity has been discussed.

No similar metabolic dysfunction has been noted in mice on Fox Chow or on the same semi-purified diet with a modified Osborne-Mendel salt mixture in place of the modified Jones-Foster salt mixture.

Fatal convulsive seizures accounted for many deaths at middle age. This was found to be partially associated with the dietary regimen. Caloric restriction and vitamin B₁₂ were effective in preventing or delaying convulsive deaths while a Crisco diet induced a high incidence of fatal convulsions.

The rate of growth and the adequacy of a diet in respect to its effect on life span was also discussed.

Microfilm copy of complete manuscript of 113 pages, \$1.41. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-780.

**THE PITUITARY-ADRENAL FACTOR
IN SODIUM HOMEOSTASIS**

(Publication No. 7294)

Daniel Harold Simmons, Ph. D.
University of Minnesota, 1953

Considerable evidence has been accumulated indicating that secretions of the adrenal cortex and the anterior and posterior pituitaries affect the rates of excretion of sodium and other electrolytes.

The assumption had often been made that these effects implied that the endocrines involved regulated the rate of sodium excretion in adjusting to equal that of sodium intake. However, no direct proof of this assumption exists, while certain experimental data and theoretical considerations suggest that this is not true.

In this study, an empirical method was devised for measuring the "sodium-retaining activity" of the kidney in various states to evaluate the adrenal-pituitary theory of the regulation of sodium excretion. Initially, the previously described natriuretic effect of osmotic diuresis was noted. In addition, it was observed that, while sodium loss of moderate degree occurred early during diuresis with 25% mannitol solution given dogs at the rate of 0.44 c.c./kgm/min., there was a sharp increase in the rate of loss at higher urine flows as the diuresis progressed. The point at which this increased rate of loss began appeared to be related to the previous sodium intake of the dog.

The tubular rejection fraction (TRF) of water and sodium (the fraction of filtered water and sodium appearing in the urine) were therefore determined for two control clearance periods and for 4 to 6 periods during mannitol diuresis during each experiment by measurement of creatinine clearance, serum sodium concentration, urine flow, and rate of urinary sodium excretion in each period. Paired values of TRF H₂O and TRF Na were plotted for each clearance and regression lines fitted to all points after the increased rate of sodium loss was observed. The intercept of this regression line on the x-axis (the "x-intercept") was used as a measure of sodium-retaining activity, and was found to be inversely correlated to a high degree with the previous sodium intake of the experimental animal as would theoretically be expected.

In the first group of experiments, three dogs were each subjected to the procedure above after one week of low sodium diet (400 mgm. Na per day) and later after a high sodium diet (60-80 Gm. Na per day). These same experiments were then repeated with the daily subcutaneous administration of 2.2 mgm./kgm./day of DCA in oil during the week of preparation. By analysis of variance on the x-intercepts, it was demonstrated that alteration in sodium intake had a marked effect on "renal sodium-retaining activity," while DCA administration had none.

In a second group of experiments, normal and totally hypophysectomized dogs were subjected to mannitol diuresis after a week of preparation on the low sodium diet and after a week of continuous intravenous infusion of 1.5% NaCl solution at gradually increasing rates and averaging 7.5 Gm./kgm. of NaCl during the last 24 hours preceding the diuresis. During the week of preparation, minor differences were noted between the normal and hypophysectomized dogs only with NaCl loading. The results of the mannitol diuresis, as reflected in the calculated x-intercepts, revealed an effect due to hypophysectomy which was minor as compared to the effect due to alteration in sodium intake.

Further observations on potassium loss during osmotic diuresis, and the importance of renal

osmotic work, concentration maxima, etc. on the natriuresis of osmotic diuresis were also presented and discussed.

In summary, these studies reveal alterations in renal "sodium-retaining activity" secondary to alterations in sodium intake which are not reproduced by or affected by DCA administration or hypophysectomy. The implication of these studies is therefore that neither the adrenal cortex nor the anterior or posterior pituitary is necessary for the regulation of sodium excretion, and that the normal mechanism can operate independently of them.

Microfilm copy of complete manuscript of 123 pages, \$1.54. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-781.

TEMPERATURE, ION, AND SUBSTRATE EFFECTS ON THE RAT VENTRICLE STRIP

(Publication No. 7512)

Gerald Bonar Sutherland, Ph. D.
Stanford University, 1954

A description has been given of the design and operation of the apparatus used in studying the response of the isolated ventricle strip of the rat. Threshold, and static and dynamic response of normal tissue to gas-phase, temperature, ionic variations, and stimulation rate has been presented, and the effect of these variables on the intracellular potassium and glycogen levels studied. From the results of the ionic variation studies an optimum solution was devised, (Reference solution) to which the results of other maneuvers were compared. An optimum temperature (27°C.) and gas-phase (100% O₂) were found. The hypodynamic state has been investigated to determine which environmental factors were of particular importance in the process of activity decrement. It has been shown that progressive loss of bicarbonate, lack of exogenous substrate, and high temperature are the major factors affecting the rate of decrement, whereas endogenous substrate (glycogen) and carbon dioxide have been shown not to contribute significantly. These results have been interpreted to signify that the development of the hypodynamic state is associated with the reduction of the pH of the tissue. This, at least in the bicarbonate studies, is probably due to increased intracellular chloride. The increased intracellular chloride might then bind to actomyosin, and decrease the bound ATP. This view is supported by the beneficial action of HCO₃⁻ upon the hypodynamic tissue. This finding has been interpreted as indicating that the mechanism of the experimental hypodynamic state observed in the present experiments is that of progressive chloride poisoning, which decreases ATP binding, hence contraction. The facility with which this state is reversed by HCO₃⁻ lends credence to this view, and suggests that the process of activity decrement (observed in the present studies) is largely physical rather than metabolic.

Microfilm copy of complete manuscript of 183 pages, \$2.29. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-782.

BRAIN STEM CONTROL OF MICTURITION AND RESPIRATION

(Publication No. 7203)

Pei Chin Tang, Ph. D.
University of Washington, 1953

Cystometrograms were determined on cats before and after various neural lesions. Bladder volume was periodically increased by introduction of 4 cc. of fluid through a catheter at two-minute intervals and intravesical pressure at each volume was determined by a water manometer. The slope of the pressure-volume curve (cystometrogram) plotted from these data indicated the state of bladder tonus. The volume just sufficient to initiate micturition (micturition threshold) indicated the excitability of the micturition reflex. Bladder tonus was the same in normal, decerebrate and spinal cats, despite manifold changes in the excitability of the micturition reflex. The tonus remained unchanged following administration of the ganglionic blocking agent, tetra-ethyl ammonium chloride or following sacral rhizotomy. Anesthesia with ether or sodium pentobarbital in dosage sufficient to abolish the micturition contraction had no effect on bladder tonus. Even death of the animal did not alter bladder tonus. These findings indicate that bladder tonus is not subject to either central or peripheral nervous control. Change in bladder tonus as indicated by the progressive shift of the ascending limb (Segment III) in the cystometrograms occurred with successive cystometric determinations. This suggests that bladder tonus reflects the physical state of the bladder wall which changes as a result of the stretch involved in the filling of the bladder during cystometric determination.

Studies on cats combining cystometry with transection of the neural axis at various levels indicated that the micturition reflex is facilitated or inhibited from at least four levels of the neural axis, namely (i) a cerebral inhibitory region, (ii) a posterior hypothalamic facilitatory area, (iii) a mesencephalic inhibitory area, and (iv) an anterior pontine (isthmus) facilitatory area. The inhibitory effect of the cerebrum was revealed by a striking reduction in micturition threshold following transhypothalamic decerebration. The facilitatory effect of the posterior hypothalamus was shown by the increase in micturition threshold following supracollicular transection in transhypothalamic decerebrate animals. Inhibition from the midbrain was demonstrated by the sharp reduction in micturition threshold following intercollicular transection in supracollicular decerebrate preparations. Facilitation from the anterior pontine (isthmus) area, as previously described by Barrington, was demonstrated by the complete abolition of the micturition reflex following either

subcollicular or spinal transection performed on an intercollicular decerebrate preparation. All these areas except the cerebral were minutely localized by discrete electrolytic lesions placed with the Horsley-Clarke stereotaxic instrument. The posterior hypothalamic micturition facilitatory area was located in the mammillary region, the midbrain micturition inhibitory area in the upper tegmentum at the caudal superior collicular level and the anterior pontine micturition facilitatory area in the upper tegmentum at the isthmus level.

Nervous control of respiration was studied by observing effects of various brain stem transections on respiratory movements pneumographically recorded. Bilateral vagotomy in decerebrate cats invariably produced a decrease in rate and an increase in depth of respiration. In vagotomized cats, transection of the brain stem caudal to the inferior colliculi resulted in a respiratory pattern characterized by long pauses in inspiration (apneustic breathing). Such animals, however, survived for hours and showed signs of rhythmic respiration. Secondary transection below the striae acousticae converted apneustic breathing to rapid phasic respiration (gasping). The results indicate that rhythmicity of the bulbar respiratory centers does not depend wholly on afferent influx from vagal and pneumotaxic systems as proposed by Pitts, Magoun and Ranson. In vagotomized cats, decerebrated at the mid-collicular level, small bilateral lesions in the extreme dorso-lateral portion of the anterior pontine tegmentum (the isthmus) consistently produced apneustic breathing. It was concluded that the pneumotaxic center lies in this portion of the isthmus.

Microfilm copy of complete manuscript of 147 pages, \$1.84. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-783.

THE CENTRAL ARTERIAL PRESSURE PULSE CONTOUR AS AN INDEX TO LEFT VENTRICULAR STROKE VOLUME IN MAN

(Publication No. 7271)

Homer Richards Warner, Ph. D.
University of Minnesota, 1954

In studying physiologic events associated with rapid changes in cardiovascular hemodynamics it becomes essential to measure beat-to-beat changes in stroke volume. The following is a method for estimating stroke volume changes from central arterial pressure pulse in man.

Since the left ventricle ejects its contents into a distensible aorta at an inconstant rate and only periodically, a pressure wave is generated. Thus, pressure recorded in the aorta or a large artery will vary with the time in the cardiac cycle (t) and the distance of the recording site from the aorta valve (x)

$$1) P = f(x, t)$$

As blood runs out of the arterial bed continuously but is ejected into it only during systole, the diastolic run off is made up of blood stored in the system at the end of systole. This is the change in volume of the arterial bed between the onset and the end of systole (U). To find the change in pressure that corresponds to this volume change, the mean pressure (P) over the length of the tube (x) must be known at these same two instants of time. This could be determined from a pressure time curve if (x) were known as a function of (t).

It has been found that pulse wave velocity (dx/dt) is an increasing non-linear function of (x). However, mean velocity ($\Delta x/\Delta t$) between two recording points on the system was found to vary linearly with mean velocity between any two other points in the arterial bed. Thus the mean pressure over a segment of the pressure - time curve serves as an index to the mean pressure over the corresponding pressure - distance curve (Pmd) and changes in transmission time between the two recording points serve as an index to transmission time down the length of the tube.

As a first approximation it is assumed that both volume and flow are linearly related to pressure. Thus the volume draining from the arterial bed during systole (Sd) is related to the volume draining during diastole (Dd or U) as follows:

$$2) \text{ Stroke volume (SV)} = Sd + Dd$$

$$3) Dd = U$$

$$4) (\text{Flow}) = dV/dt = K (P-20) \\ \text{on integration}$$

$$5) \Delta V (\text{systole}) = Sd = K \int_{t_1}^{t_2} (P-20) dt = K_1 Sa$$

$$6) \Delta V (\text{diastole}) = Dd = K \int_{t_2}^{t_1} (P-20) dt = K_2 Da$$

where t_1 and t_2 are the times of onset and end of systole respectively, corrected for the time lag in transmission of the pulse wave. Then if $K_1 = K_2$

$$7) Sd/Dd = Sa/Da$$

$$\text{and } 8) Sd = U(Sa/Da)$$

$$\text{then since } 9) U = K (Pmd)$$

$$10) S.V. = K (Pmd) (1 + Sa/Da)$$

The value for the proportionality constant relating ΔV to ΔP is obtained from equation (10) by carrying out a determination of cardiac output during a steady state by the Fick or the Dye method. This constant is then used to determine subsequent values for stroke volume from recordings of the central pulse and compared with the values obtained by the control methods.

Ten normal subjects and three patients with valvular heart disease have been studied. Agreement between the values obtained by the pressure pulse and the control method were well within the expected error of the control method under conditions of exercise, tilt to various positions, and inflation of an

anti-blackout suit which applies 75 mm Hg. pressure to the entire body below the xiphoid. It is recommended that the method be carefully controlled, at least at the outset, when used under conditions other than those already tested.

Microfilm copy of complete manuscript of 57 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-784.

POLITICAL SCIENCE

POLITICAL SCIENCE, GENERAL

FOUR AMERICAN COLUMNISTS: A STUDY
IN THE PARTISAN ANATOMY OF
DAVID LAWRENCE, WALTER LIPPMANN,
DREW PEARSON, GEORGE SOKOLSKY

(Publication No. 7220)

Morton John Cronin, Ph. D.
University of Minnesota, 1953

This dissertation described a segment of the regular journalistic product of four nationally-syndicated political columnists. The segment consisted of those columns which they distributed for publication during the first six months of 1951.

The statements relevant to this analysis were those which involved the executive, legislative, or judicial branches of the federal government; the Democratic or Republican Party; foreign countries; the dissemination of news; business or labor; and minority groups in the United States.

The technical problem was to describe adequately the columnists' statements in these areas in both quantitative and qualitative terms. Thirty-four categories were devised for the purpose of counting the number of times the columnists referred to various items in the areas just enumerated. The items in each category were then classified according to the favorable, unfavorable, or neutral treatment they received. The qualitative portion of the description consisted chiefly of indicating, by means of quotations and summaries, the grounds upon which the treatment was given; and of suggesting, by the same means, the degree of intensity which characterized the treatment.

The dissertation had two primary purposes. The first was to contribute to the technique of quantitative analysis in the realm of political writing. One contribution, for instance, consisted of demonstrating that an adequate picture of a columnist's partisanship could only be obtained, even in a single area, if his views were analyzed at successive levels of expression. His treatment of Democratic Congressmen, to cite only one example, was not even a roughly accurate index of his treatment of the Democratic Party.

The second purpose was to contribute information that would be helpful in assessing the degree to which diversity of opinion and interpretation is characteristic of the American press.

Microfilm copy of complete manuscript of 431 pages, \$5.39. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-785.

THE IDEA OF JUSTICE IN
SOCIOLOGICAL JURISPRUDENCE

(Publication No. 7269)

Eugene Victor Walter, Ph. D.
University of Minnesota, 1953

The purpose of this study is to treat sociological jurisprudence analytically and critically on the one hand, examining its presuppositions and philosophical foundations, and historically on the other hand, relating it to the development of the idea of justice in Western political and legal thought. An attempt is made to show that the roots of sociological jurisprudence lie deep in intellectual history and that the school does not spring full-blown from the nineteenth century. One hypothesis explored is the suggestion that in sociological jurisprudence the old classical political ideal makes its reappearance, based on modern presuppositions.

The problem of justice is seen as the dialectic between the individual and society. Formulations of an idea of justice are found in a network of pre-suppositions - epistemological, cosmological, ethical, psychological and anthropological - which are conditioned by the historical epoch and the circumambient culture in which they appear but also are transcendent to these conditions, based on alternative sets of values that are perennial. An attempt is made in this dissertation to clarify the presuppositions, the philosophical foundations and the methods of schools of juridical thought which are related historically or dialectically to sociological jurisprudence. The pre-suppositions of the classical conception of justice are analyzed and traced through the medieval and modern periods to their present expression, and the significant metamorphoses are indicated. Some important contemporary assumptions underlying the concept of justice are compared with those underlying the classical ideal. The trends reflected in the twentieth-century schools are briefly discussed and shown to culminate in sociological jurisprudence. Nevertheless, certain strains inherited from the classical view of justice and political institutions were to persevere in contemporary

jurisprudence although based on a different set of pre-suppositions.

In the second Part of the study there is an examination in extenso of the sociological jurisprudence of Roscoe Pound who presents the most systematic and influential exposition of this school of thought. Attention is given in turn to the background of Pound's thought, his precursors and those who have exerted marked intellectual influence upon his system, the influence of his botanical career upon his legal thought, and the significance of his implicit ecology of law. His writings are discussed thematically, drawing out his views on law and society: the jurisprudence of interests and social engineering, law and morals, and law and the state. These themes are integral parts of the idea of justice in sociological jurisprudence.

The concluding section examines the polemical attacks on sociological jurisprudence as a theory of justice. These criticisms come primarily from the natural law school on the one hand, and from the neo-realist group (itself an offshoot of the sociological school) on the other hand. In the concluding chapter further inadequacies of the sociological school are indicated but its merits are also pointed out. Some important human problems which should be taken up but are usually ignored by most schools of legal thought are briefly considered and some suggestions made for their future investigation. Finally, a theoretical position making use of the strengths but

overcoming some of the important deficiencies of the sociological school is offered. Sociological jurisprudence persists in maintaining an atomistic or individualistic conception of society, considering social relations as radiations of individual bio-psycho-social units in contact. In contrast the position here defended maintains a thoroughgoing functionalism, declaring that the basic elements in the legal order should not be conceived as individuals and their desiderata but as relationships. Interrelated activities and coordinated behavior should be the source of legal norms and not the independent existences of individual persons. The working out of each person's individual existence is not the task of law but of morality and personal conscience. One function of this dualism between social relationships and personal existence is the protection of the individual's subjective life from the formalism and tyranny of political and legal norms. These rules and the machinery that makes them have legitimate jurisdiction over man as coordinate with his fellows and not over man the solitary one.

A diagrammatic sketch of the development of the idea of justice in major schools of juridical thought is included as an Appendix.

Microfilm copy of complete manuscript of 372 pages, \$4.65. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-786.

PSYCHOLOGY

PSYCHOLOGY, GENERAL

THE EMOTIONAL REACTION ON ADMISSION TO A TUBERCULOSIS HOSPITAL

(Publication No. 7467)

David G. Berger, Ph. D.
Michigan State College, 1952

The purpose of this research was to investigate the emotional response on the part of persons entering a tuberculosis treatment facility as patients for the first time. Three psychological instruments were used to evaluate the reaction; the Rorschach, an original Word Association test, and the Digit-Span test taken from the Wechsler Bellevue Intelligence Scale.

An experimental group of forty newly-admitted patients and a matched control group of forty patients who had been hospitalized for at least six months were utilized. The experimental group were seen on the day of their arrival at the hospital and again six weeks later in a retest situation. The control group was similarly tested twice with a six-week interval between tests. To analyze the effect of the admission experience on the tests the difference between the shifts in the scores in the two groups from the first to the second test was calculated.

The major hypothesis tested was that the initial admission into a tuberculosis hospital would provoke a stress reaction recognizable in the test performance. The study was considered disparate from other psychological investigations of the human response to stress. First the problem involved a real-life situation involving stress as compared to the more traditional simulated laboratory stress employed in most other studies. Second the effects of stress were measured over a period of time rather than simply measuring the immediate response under threat as done heretofore.

The Rorschach test was examined both atomistically in terms of the single scores and also in its total configuration. Atomistically stress tended to affect the protocol by; (1) decreasing productivity, (2) increasing reality testing, (3) decreasing the breadth of interest, (4) increasing reaction time, (5) increasing the number of whole responses, (6) decreasing the number of common detail responses, (7) decreasing inner phantasy, (8) decreasing emotional contact with the environment, (9) increasing feelings of inferiority, (10) increasing evasive defenses, and (11) decreasing the ability to think in terms of group standards. In terms of the configurational analysis it was shown that the entire Rorschach record reflected the effect of the stress situation.

The Word Association test was analyzed both in

terms of response time and adequacy of response. The stress involved in the admission situation influenced the response to the test as evidenced by a delay in reaction time as well as in a less adequate response. Disturbance on this test was reflected both in response to specifically "loaded" words as well as to test in general. Specificity of disturbance was revealed most clearly by the reaction time analysis while generality of disturbance was best reflected by the adequacy of response type of analysis.

The Digit-Span test proved capable of measuring the stress situation in terms of the three scores obtained. Stress reduced the digits-forward, the digits-backward, and the total digits scores.

The major hypothesis was considered substantiated by the results and it was felt that the three tests could be considered sensitive to the type of stress situation encountered in this study. The study was also thought to have heuristic value in promoting a sample and situation for future research in the problem of anxiety.

Microfilm copy of complete manuscript of 118 pages, \$1.48. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-787.

SERIAL ROTE LEARNING AS A FUNCTION OF ANXIETY

(Publication No. 7159)

Ralph A. Enrick, Ph. D.
Michigan State College, 1953

Two principal hypotheses respecting anxiety and verbal learning were under investigation: Spence's and Taylor's hypothesis (3) that anxiety, as drive, multiplicatively augments the absolute difference in strength between correct and incorrect response tendencies; and the present experimental hypothesis that task-oriented anxiety responses aid learning, while disruptive anxiety responses impede it. An attempt was made to minimize task-oriented anxiety by using a non-college population and a real-life stress situation as a source of anxiety.

A study by Berger (1), using Rorschach, Word Association, and Digit Span Tests, had indicated that newly admitted tuberculosis patients were significantly more anxious than long-term hospitalized tuberculosis patients. The present design therefore employed 40 new tuberculosis patients as an experimental group, and 40 old patients (hospitalized six months or more) as a control. Half of each group learned a list of nine nonsense-syllables plus a list of nine "anxiety-related words," with 20 trials for each; the other half learned one list of nine difficult

nonsense syllables, being allowed 40 trials. A digit Span Test, which had succeeded in differentiating "high-anxious" from "low-anxious" subjects in Berger's and other studies, was given to all subjects.

Contrary to expectations, no significant differences between new and old patients were found on any of the three learning tasks or on the Digit Span Test. It was concluded that there was insufficient evidence for assuming that differences in anxiety level existed between the two groups. The comparison thus failed to provide an adequate test of learning under anxiety. If differences in anxiety level did exist, they failed to affect the learning tasks.

Using the same population, a comparison was also made between patients scoring high and low on Taylor's Anxiety Scale (4). Differences in learning were again statistically non-significant. In the case of the easy list, however, there was a trend in favor of the low-anxious group ($P = .10 - .20$). This was contrary to Montague's findings (3) and in line with the present hypothesis that high-anxious non-college subjects would do less well in the learning of the easy task, due to the prevalence of disruptive anxiety and the absence of task-oriented anxiety. The present tentative finding encourages hopes for a future investigation along similar lines with a larger sample.

An additional experiment was performed with 119 Michigan State College students, using the Anxiety Scale and a list of 12 easy nonsense syllables, allowing 19 trials. Top and bottom twenty per cent on the Anxiety Scale constituted high- and low-anxious subjects respectively. Group administration was used, and individual achievement was deemphasized in order to minimize anxiety arousal. In accordance with the experimenter's hypothesis that anxiety facilitates learning only when task-oriented anxiety responses are aroused, and contrary to Montague's findings (3), high-anxious subjects learned the list no better than low-anxious subjects.

The results of the second and third parts of the present investigation are held to be more in line with the present theoretical framework than with Spence's and Taylor's construct of anxiety as drive.

REFERENCES

1. Berger, D. The emotional reaction on admission to a tuberculosis hospital. Unpublished doctor's thesis, Michigan State College, 1952.
2. Montague, E. K. The role of anxiety in serial rote learning. *J. exp. Psychol.*, 1953, 45, 91-95.
3. Spence, K. W., and Taylor, J. A. The relationship of anxiety level to performance in serial learning. *J. exp. Psychol.*, 1952, 44, 61-64.
4. Taylor, J. A. Relationship of anxiety to the conditioned eyelid response. *J. exp. Psychol.*, 1951, 41, 81-92.

Microfilm copy of complete manuscript of 120 pages, \$1.50. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-788.

A JOB ANALYSIS BY THE METHOD OF CRITICAL INCIDENTS OF PSYCHIATRIC AIDES IN MENTAL HOSPITALS

(Publication No. 7280)

James Noble Farr, Ph. D.
University of Minnesota, 1952

The present study has determined the critical requirements of the job of Psychiatric Aide, using the Critical Incident Technique as a means of job analysis. This technique yields descriptions of "successful" and "unsuccessful" on-the-job behaviors. These descriptions were categorized and represent job requirements which are crucial for the Aide to meet effectively if he is to succeed.

Data were collected in nine state hospitals in Minnesota. Seven were mental hospitals, one was an institution for the feeble-minded, and one was an institution for the care of epileptics. Graduate Nurses and experienced Psychiatric Aides in these institutions submitted "critical incidents." A total of 352 questionnaires were completed, containing 1,233 incidents.

Of the 1,233 incidents, 278 were discarded because they were general descriptions of the good or poor Aide rather than descriptions of specific successful Aide behaviors.

The remaining 955 descriptions were categorized to determine the critical requirements of the job. Similar behaviors dealing with specific tasks or problems were grouped. This resulted in a listing of 142 on-the-job behaviors which had occurred two or more times, plus 35 behaviors which appeared only once in the data.

These specific behaviors were then combined into larger groupings in which the behaviors all dealt with the same problem of patient care or Aide-patient relationships.

This process resulted in a list of 18 job requirements, the meeting of which most frequently result in success or failure judgments of an Aide by other Aides and Nurses. Under each requirement are the behaviors which are effective and ineffective in meeting the requirement.

These lists of behaviors have three important uses in a selection, training, and evaluation program for Aides: (a) they are the behaviors which must be predicted by any valid selection device; (b) they are the behaviors the Aide must be trained to carry out or avoid; (c) they are the behaviors which must be observed and weighted in any merit evaluation program. The objective of any such personnel program is to produce employees who are judged successful, and these are the behaviors upon which this judgment rests.

The data are most obviously and directly useful in the training and evaluation aspects of the program. In the training program this list of behaviors provides the basis for instruction. It shows clearly what the Aide should be trained to do and not to do. Attitudes which underly successful performance can be inferred from the behaviors, and these should be emphasized in the training.

In the evaluation program, the list of behaviors will serve as the basis of a merit rating scale. These are the behaviors which have resulted in the judgment of an Aide as good or poor. They can now be systematically observed in evaluating workers for purposes of promotion, further training, counseling, or developing of criterion groups.

In the development of selective devices the list may be a useful source of items measuring interests and attitudes which underly successful performance.

Microfilm copy of complete manuscript of 132 pages, \$1.65. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-789.

FORCED-CHOICE VS. L-I-D RESPONSE ITEMS IN VOCATIONAL INTEREST MEASUREMENT

(Publication No. 7257)

Dallis Kay Perry, Ph. D.
University of Minnesota, 1953

This study determines whether forced-choice interest items give better results than L-I-D interest items. The data were also used to cross-validate three existing interest keys, to study relative merits of multiple-weight and unit-weight interest keys and to compare the effectiveness of item content from two different interest inventories.

The literature suggested that vocational interest keys hold up well in cross-validation, but no conclusive evidence, in favor of either L-I-D or forced-choice items, in favor of multiple-weight or unit-weight keys, or in favor of any particular kind of item content, was found.

Three interest inventories were administered to 135 Navy yeomen (Navy clerical workers) and to 167 college students. One inventory was the Strong Vocational Interest Blank (SVIB). Another (Form F) consisted of 138 forced-choice triads from the Minnesota Vocational Interest Inventory (MVII). The third (Form M) consisted of the same items as Form F, but in L-I-D form.

The yeomen were scored on Strong's Office Worker key and on the Yeoman and Shipping-Stock Clerk keys of the MVII. Yeomen's scores on the Yeoman and Shipping-Stock Clerk keys were quite similar to those of the criterion groups for these keys. It was concluded that the Yeoman key cross-validates excellently and that the validity of the Shipping-Stock Clerk key generalizes to yeomen. The difference between yeomen's scores on Strong's Office Worker key and scores of the criterion group for the key was considerable. It was concluded that the validity of the Office Worker key does not satisfactorily generalize to yeomen in general. Yeomen indicating occupational satisfaction received much higher mean scores on all three keys than those indicating dissatisfaction. It was concluded that validity of all three keys is higher for satisfied yeomen and that the validity of Strong's Office

Worker key generalizes to occupationally satisfied yeomen.

Experimental multiple-weight keys using Strong's weighting system and unit-weight keys based on 20 per cent differences were constructed for each inventory to differentiate yeomen from a group of 100 students used as a reference group. The keys were cross-validated against the remaining 67 students. The keys were then compared in terms of validity, as shown by a small amount of overlapping of the yeoman group with the reference student group and in terms of cross-validity, as shown by a small amount of overlapping of the yeoman group with the cross-validation student group and by a large amount of overlapping of the two student groups with each other.

No appreciable differences in validity or cross-validity were found between unit-weight and multiple-weight keys. Since multiple-weight keys contain many more items and scoring weights than unit-weight keys, it was concluded that unit-weight keys are just as effective but more economical than multiple-weight keys.

Two experimental "yeoman interest keys" based on items (chiefly L-I-D) in the SVIB provided less overlapping of yeomen with either student group than did two experimental yeoman interest keys based on the L-I-D form (Form M) of items from the MVII. The two student groups overlapped less on the Strong keys than on the Form M keys, however, showing poorer cross-validity for the Strong keys. It appeared that greater heterogeneity of content in Strong's inventory was responsible for the differences.

Keys based on the forced-choice inventory provided more differentiation between yeomen and students than did keys based on the L-I-D inventory. The differences were small but statistically significant.

It was concluded that heterogeneous forced-choice items, given unit scoring weights, produce the best interest keys. However, differences in results achieved by techniques investigated in this study are so slight that personal preference may well play a major part in selection of techniques to be used.

Microfilm copy of complete manuscript of 216 pages, \$2.70. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-790.

A COMPARISON OF RATING, TEST, AND SOCIOMETRIC METHODS OF PERSONALITY MEASUREMENT

(Publication No. 6395)

David Lawson Russell, Ph. D.
University of Minnesota, 1953

In order to clarify and to understand more clearly the many meanings which the concept of adjustment seems to represent in contemporary

personality theories, several rough categories of adjustment concepts are suggested: functional, statistical, egocentric, sociometric, and ethical. The present study attempts to determine the degree to which three methods of personality assessment representing three of these adjustment concepts are related and to observe complex interrelationships between these personality measures in order to test the hypotheses of self-conflict, reality, and projection.

Chosen to represent the statistical criterion of adjustment is the Minnesota Personality Scale, which measures five traits – morale, social adjustment, family adjustment, emotionality, and economic conservatism. Group-ratings of the individual on five corresponding bipolar traits are considered a further statistical criterion of adjustment. To represent the egocentric criterion of adjustment, the following ratings on these scales were obtained: (a) self-ratings, or ratings of a person by himself; (b) expected-ratings, or ratings a person expects to receive on the average from others in the group; (c) given-ratings, or ratings given by an individual to others. A sociometric questionnaire, asking for choices of associates based upon actual and desired friendship, popularity, and leadership represented the sociometric criterion of adjustment. All of these measures were obtained from a group of 61 fraternity men at a small eastern liberal arts college.

While rating scale traits of social adjustment, morale, and emotionality tend to cohere rather consistently, most trait intercorrelations are generally low and inconsistent enough to warrant considering these scales as independent measures of adjustment with marked specificity, depending upon the trait being rated and the source of the rating. A "socialization factor" is postulated to account for increasing homogeneity between trait judgments as we move from self-ratings, through expected- and given-ratings, to group-ratings.

Of the three adjustment measures, those involving group-judgments of the individual – group-ratings and sociometric scores – are most highly related. The relationships become smaller, but still significant, in comparing group-ratings with their corresponding Minnesota Personality Scale traits. No significant association is apparent between test and sociometric measures of adjustment. It is noted that most significant correlations are low and positive.

Although a few egocentric self-estimates are related in a low and positive manner to the statistical measures of adjustment, the self-judgments are unrelated to sociometric criteria. Given-ratings, which might be considered an egocentric measure, are unrelated to any of the adjustment criteria.

It is concluded that, while there are intricate networks of interrelationships existing between traits and their measures, there is much specificity. A person might be well-adjusted in a statistical or egocentric sense, but this might not mean that he is well-adjusted in the sociometric sense, or vice versa. This implies that an effective personality theory or therapeutic program must be as comprehensive as possible in accounting for all areas of adjustment.

Self-conflict, defined as a discrepancy between self- and expected-ratings, is found to be unrelated to the adjustment criteria. Reality of self-perception, as shown by discrepancies of self-estimates from group-ratings, bears little relation to sociometric or test criteria of adjustment. The projection hypothesis, which postulates the assignment of poor ratings to others by an individual in those traits in which he is or regards himself as being deficient, receives inadequate support. Rather, it would appear that the individual rates others accurately and realistically. It is concluded that within the limits of this study the hypotheses of self-conflict, reality, and projection receive too little confirmation to be considered as important aspects of the adjustment process.

Microfilm copy of complete manuscript of 347 pages, \$4.34. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-791.

RELATIONSHIPS OF PERSONALITY FACTORS AND RELIGIOUS BACKGROUND AMONG COLLEGE STUDENTS

(Publication No. 7297)

Hirsch Lazaar Silverman, Ph. D.
Yeshiva University, 1951

Statement of Problem

Definition of Scope

This dissertation is a study of the relationships of personality factors and religious background of individuals within a college group. The underlying purpose of the study is to investigate the relationships among college students of the factors that make up their religious background and their personality structure as measured by certain instruments.

To attain this objective, in addition to using certain standardized objective tests, the investigator devised two instruments: Inventory, Part I, a religious background factors questionnaire; and Inventory, Part II, a religious attitudes questionnaire.

From the first inventory, three separate scales were derived from 40 items: (a) religious affirmation score; (b) religious participation score; and (c) religious background score. From Inventory, Part II, a religious attitudes score was obtained from 50 questions on religious matters.

Methods of Procedure

This study is based in part on the use of standardized objective tests of emotional adjustment and measurement of personality; they are: (a) A Study of Values, by G. W. Allport and P. E. Vernon; (b) Controlled Association Test, by J. B. Maller; (c) The Guilford-Martin Inventory of Factors, by J. P. Guilford and H. G. Martin; (d) Inventory, Part I (religious background factors); and (e) Inventory, Part II (religious attitudes).

The investigator grouped the facts and data and noted relations between and among them, and made

a scientific analysis of the relationship of factors of personality adjustment and religious background.

Sources of Data

The data were obtained through signed questionnaires, three objective psychometric tests, and two inventories prepared by the investigator for use in this study, together with references to the literature in the field bearing on the problem. Almost four hundred (400) seminary and college students were tested with Inventory, Part II, for purposes of gathering statistical data. The investigator administered that instrument at seven colleges and universities; and analyzed the data in terms of correlations and relationships. Inventory, Part I, as well as Inventory, Part II, and the standardized tests were administered to the college group of 184 students at the Newark College of Rutgers University.

The data were presented in analysis, based on statistical tables and correlations, as follows: (a) Analysis of background differences of the students with respect to age, general education, religious training, socio-economic status, and other factors; (b) Tables of frequency distribution of responses of the college students to the tests and instruments; (c) Tables showing analyses of responses of items; (d) Distribution of responses to the background and interest inventories of the college group; and (e) Statistical analysis of the attitudinal similarities, as well as differences.

Summary of Findings

In the summary of the data which constitutes Chapter VII and conclusions in Chapter VIII of the thesis, the investigator deals with the following: (1) The relationships that point to a theoretical as well as a practical value for educational, religious and psychological training; (2) The significant agreements or differences among the students, in terms of background and attitudes, defined on the basis of accumulated data; (3) Basic references to source materials for interpretation and analysis of data and findings; and (4) Study of the religious qualities in terms of personality adjustment and the significance of the differences are also pointed out.

Selected bibliographical references and sources are listed, with specific listings included in each chapter. Copies of the tests and instruments used in the preparation of the thesis are included in the appendices.

Conclusions and Recommendations

In the concluding chapters of the thesis, the investigator noted in analysis statistical findings, and evaluatively and interpretatively indicated the implications of the findings for the areas of education, religion, sociology, and psychology.

Microfilm copy of complete manuscript of 153 pages, \$1.91. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-792.

BEHAVIORAL CORRELATES OF AUTHORITARIAN PERSONALITY

(Publication No. 7514)

William DeWitt Wells, Ph. D.
Stanford University, 1954

This experiment was an investigation of the behavioral correlates of authoritarian attitudes. The subjects were individuals who scored in the upper and lower quartiles of the California F (fascistic) scale. Detailed records were made of their behavior in small, student-centered discussion classes. Twelve hypotheses were derived from the differences that theoretically obtain between high scorers and low scorers, and the hypotheses were tested with data from the behavior records. The hypotheses were:

1. High scorers' ratings of the leader would be more flattering than low scorers' ratings.
2. On the final rating scales, high scorers would rate the leader higher in "Agreement," "Influence," and "Importance" than low scorers.
3. High scorers would check more of the extremely complimentary response alternatives on the "Comments on the Course" questionnaire.
4. High scorers would make a larger proportion of the following types of remarks: asking for orientation, asking for opinion, and asking for suggestions.
5. The correlation between rated satisfaction with a discussion and leader participation in that discussion would be higher for high scorers than for low scorers.
6. High scorers would cut class more often than low scorers.
7. High scorers would be late to class more often than low scorers.
8. High scorers would be more stereotyped (less variable) than low scorers in setting levels of aspiration before tests.
9. High scorers' "Satisfaction" ratings would show less day-to-day variability than low scorers'.
10. High scorers' "Participation" ratings of other members of the group would agree less closely than low scorers' with actual participation recorded by observers.
11. There would be a closer resemblance between high scorers' self-ratings and their ratings of the leader than between low scorers' self-ratings and their ratings of the leader.
12. High scorers would make a larger proportion of the following types of responses: those showing disagreement, those showing tension, and those showing antagonism.

The data supported only one of the twelve hypotheses (number 3). The high scorers were more emphatic than the low scorers in stating that the course had encouraged independent thinking about psychological problems, that the course had helped self-understanding, and that the course had provided insight into important social problems.

In the discussion of these results, it was suggested that a major portion of the correlation

between F score and perceptual and cognitive variables may be due to the fact that the same individual reports both his own attitudes and his own perceptions and cognitions; i. e., the measurement of the independent variable is not independent of the measurement of the dependent variable. This lack of independence is considerably decreased when – as in the present study – the individual who reports his own attitudes reports specific perceptions of specific real events rather than general ideas and opinions, or when the individual's behavior is reported by an independent observer.

The findings of this study indicate that perceptual and cognitive differences between high scorers and low scorers cannot be directly and unambiguously translated into behavioral terms.

Microfilm copy of complete manuscript of 60 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-793.

PSYCHOLOGY, CLINICAL

PREDICTION OF MALADAPTIVE RESPONSES UNDER CONDITIONS OF HABIT-INTERFERENCE FROM RORSCHACH COLOR RESPONSES

(Publication No. 7161)

Robert Willard Harrington, Ph. D.
Michigan State College, 1953

The need for adequate experimental validation of Rorschach hypotheses has long been realized by most users of the test. Regardless of the apparent usefulness of these hypotheses in dealing with individuals, attempts to test them in clinical use remain subject to errors of observation, judgment and preconceived ideas. While the application of experimental procedures to such problems does not necessarily eliminate these errors experience has shown that they make such errors less likely to occur.

One of the major propositions of the Rorschach test is that the type of response given to color is indicative of the level of emotional development of the subject. Specifically, it is held that the FC responses indicate a higher level of emotional development, i. e., emotional maturity, than do CF and C responses.

This investigation attempted to put this hypothesis to test by controlling a number of other variables and using response to color as the independent variable and reaction to conditions of frustration as the dependent variable. A major assumption underlying the investigation was that there is a positive relationship between emotional maturity and adequacy of reaction to conditions of frustration. This assumption was shown to have empirical as well as formal validity.

The experimental design consisted of selecting two groups of subjects who were equated on several

Rorschach variables as well as age and IQ. These groups were selected so that they differed on the independent variable of type of color emphasis on the Rorschach test. One group, called the FC group, had given color responses which were primarily of the FC or form-dominant type. The other, designated the C/CF group, had given color responses in which the emphasis was predominantly on the color element, i. e., C and/or CF responses. This provided two groups who differed on the variable of emotional maturity, as indicated by color responses on the Rorschach, while being equivalent in regard to other variables.

Each group was subjected to conditions of frustration and measures taken of their responses to these conditions. Habit-interference served as the frustration variable by interfering with the goal-directed behavior of the subjects. The prediction was that the emotionally immature group, i. e., the C/CF group, would show the greatest degree of impairment in performance under conditions of frustration. This prediction was clearly borne out on one of the tasks used (code-substitution) and six of the seven measures taken on the second task were in the predicted direction. It is felt that the Rorschach assumption relating the types of color responses to varying levels of emotional development is supported to some extent by these findings.

It was suggested that the type of methodology used in this study could be extended to deal with more complex types of behavior such as are met with in the clinical use of the Rorschach test.

Microfilm copy of complete manuscript of 75 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-794.

PSYCHOLOGY, EXPERIMENTAL

VASOMOTOR CONDITIONING IN HUMAN SUBJECTS

(Publication No. 7191)

Charles Wilson Harwood, Ph. D.
University of Washington, 1953

The purpose of this experiment was to determine if vasomotor conditioning can be clearly established in the laboratory and to report the development of such conditioning should it be established. Analysis of previous experiments indicated that none of them provided an adequate demonstration of vasomotor conditioning. This analysis together with information gained from extensive exploration indicated that a great many more experimental controls than were employed in any one previous experiment are necessary for an adequate approach to such conditioning.

In the present experiment nineteen human subjects were employed. They were randomly divided into a control and experimental group. The

experimental group received paired presentations of the unconditioned stimulus (a mild electric shock) and a signal (a blue light). The vasomotor responses were indirectly measured by the direct measurement of skin temperature. The temporal relationships of the conditioning procedure were: the light came on for 15 seconds, this was followed by the shock and the light simultaneously for 5 seconds at the end of which time both stimuli ceased. Vasomotor conditioning would have been demonstrated had the experimental group learned to respond to the signal. The experimental and control groups did not differ significantly in responsiveness to the signal. No group trend toward conditioning was indicated.

Two secondary findings concerning the effect of electric shock as a stimulus were: (a) at the beginning of each succeeding session the subjects judged a considerably stronger shock than they had experienced during the previous session to be equivalent in strength; and (b) the magnitude of the unconditioned response in temperature change was not clearly related to the strength of the unconditioned stimulus.

The author made suggestions concerning conditions that appear to be necessary for such conditioning to take place. The discussion compares this study to a similar one concerned with pupillary conditioning.

The major conclusions of the present study may be summarized as follows:

1. The conditioning of the vasoconstriction response cannot be obtained with the methods which were employed.
2. A critical analysis of previous experiments revealed that none of them has given a clear demonstration of vasomotor conditioning.
3. From a comparison of the experiments with the examples of vasomotor conditioning of everyday life, i. e., blushing and blanching, it appears that the subject must experience a situation involving greater urgency before such conditioning can be brought about in the laboratory.

Microfilm copy of complete manuscript of 65 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-795.

THE GENERATION OF THE FRACTIONATED GOAL RESPONSE BY DIFFERENTIAL EFFECTOR ACTIVITY AT THE GOAL BOX

(Publication No. 7232)

Marvin James Herbert, Ph. D.
University of Minnesota, 1953

This study was an investigation of the theoretical mechanism of the fractionated goal response, r_g , in which it was hypothesized that these responses are largely kinesthetic, and that an increase in selected effector activities at the goal-box would produce a greater "pool" of r_g 's ready to serve as conditioners of the maze response, and thus lead to better learning.

A single T-unit of special design was built to accommodate a series of interchangeable goal-boxes, each respectively imposing stimulus features which would elicit responses more and more like those required of a rat in making a correct discrimination at the choice-point.

Twelve albino rats were employed in each of five experimental conditions, the requirements of the various conditions determining the construction characteristics of a particular goal-piece.

Two of the goals allowed reinforcement while the animal remained motionless and parallel to the straight sides of the box; the third goal-box made it possible to reinforce the subject as he stood motionless, but curved in the direction required in making a correct choice at the T.

A final goal-piece (labelled the "rotator") made it possible to emphasize the direction and degree of turning made by an animal in performing correctly at the choice-point. This was accomplished by allowing the rat to follow a foodcup which was moved around a circular path three and a half times. Two groups of animals were run in this apparatus, one group receiving food after their circling, and the remaining twelve animals receiving food by eating from the cup as it was kept in motion.

Numerous controls – in particular, that of running all animals in darkness – were observed to eliminate extra-maze cues, and performance was measured in terms of errors and trials to criterion.

The data obtained were submitted to an analysis of variance and Fisher's *t* test, resulting in support of the major hypothesis. Four of five sub-hypotheses were either fully or partially supported, while the fifth was not supported. These conclusions are more fully stated as follows:

1. The major hypothesis, "The probability that an acting organism will learn to make the correct response at a choice-point in a maze will be increased when goal-box conditions are present which heighten the kind and degree of effector activity demanded in making that response," was supported.
2. Sub-hypothesis I, "Animals who operate in the rotation conditions will learn more readily than those in the non-rotation conditions," was supported.
3. Sub-hypothesis II, "Animals reinforced while curved in the degree and direction required in making the correct response at the choice-point will learn more readily than those reinforced while standing in normal body position," was supported.
4. Sub-hypothesis III, "Animals reinforced while rotating will learn more readily than animals in all other conditions," was partially supported.
5. Sub-hypothesis IV, "Animals rotated, then reinforced, will learn less readily than animals who are reinforced while rotating, but more readily than non-rotated animals," was partially supported.
6. Sub-hypothesis V, "Animals reinforced while motionless, but while maintaining a curved position like that demanded at the choice-point, will learn less readily than the rotated animals, but more readily than animals not required to maintain this curved position during reinforcement," was not supported.

Implications for current learning theories were considered, and suggestions were made for extending the general design of the study to further research.

Microfilm copy of complete manuscript of 100 pages, \$1.25. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-796.

THE EFFECT OF SECONDARY REINFORCEMENT ON THE LEARNING OF A MULTIPLE-UNIT MAZE

(Publication No. 7173)

Vonne Frank Porter, Ph. D.
Vanderbilt University, 1953

Supervisor: Professor Leland E. Thune

The experiment was designed to test two hypotheses stemming from Hull's reinforcement theory of learning. They were: (1) the effectiveness of differential stimulus cues in a complex learning situation should be enhanced when the appropriate (correct) cue is also a secondary reinforcer, and (2) the effect predicted in the first hypothesis should be reduced by concurrent conditioning of an inappropriate (incorrect) stimulus as a secondary reinforcer. Performance in a multiple-T maze was the dependent variable. The primary independent variables were: (1) the location in correct or incorrect maze alleys of a previously acquired secondary-reinforcing cue, and (2) the location in correct or incorrect maze alleys of a secondary-reinforcing cue concurrently acquired during maze training.

A review of the literature indicated extensive support for the concept of secondary reinforcement from simple test situations. Among the more relevant findings was that secondary reinforcement could mediate new learning or increase the rate of learning. Generalization of secondary reinforcement from black or white goal boxes to black-white discrimination stimuli was successfully demonstrated in three of the experiments which were reviewed. A retarded learning effect was found when stimulus relations (black-white) between goal box and discrimination positive stimulus were reversed or inconsistent. The present experiment included a test of the generalization of secondary reinforcement from a single-choice discrimination box, where it was acquired, to a complex test maze.

The acquisition apparatus was a straight-alley discrimination box with black and white swinging doors and a black, white, or gray goal box. The test apparatus was a 10-unit multiple-T maze. It was constructed so that all correct alleys could contain swinging doors of the same (black or white) color. All of the blind alleys contained swinging doors of the opposite black or white color. Black, white, or gray goal boxes appeared at the end of the maze.

The subjects were (108) white rats. They were deprived of food for approximately 22 hours before

all training trials. Dry food pellets were used as incentive. In the acquisition phase, half of the animals were trained to a black-positive discrimination stimulus and goal box, and the other half was trained to a white-positive discrimination stimulus and goal-box. Both groups were then trained in the maze so that different thirds of each group ran to a white, black, or gray goal box. Different thirds of each goal-box group ran to either white, black or gray positive maze doors. In the latter case, the negative doors were also gray. Thus, for some animals which ran the maze, the positive door stimulus was the same as it had been in discrimination training but for others it was "reversed" or opposite. Also for some animals, the maze goal box was the same color as the positive maze doors but for others it was the opposite color.

The analysis of variance was used to analyze the results. No differences between groups were found which could be attributed to secondary reinforcement. There was no significant difference between the maze group for which the positive maze-door stimulus was the same color as the positive discrimination stimulus and the group for which these relations were reversed. Neither was there a statistically significant difference between the group for which the maze goal box was the same color as the positive maze doors and the group for which these relations were reversed. Thus, the hypotheses concerning generalization of secondary reinforcement from a single-choice discrimination goal box to choice-point stimuli in a multiple-T maze, and from the maze goal box to choice-point stimuli failed to be confirmed.

A significant difference was found in favor of a group running to black maze doors over a group running to white maze doors. This could not, however, be interpreted in favor of secondary reinforcement since the pretraining positive stimulus and maze goal box variables were heterogeneous but balanced in the maze-door groups. A significant increase in errors for both black- and white-maze-door groups was found when the maze doors were placed in opposite choice-point sides after the completion of regular maze trials. This was interpreted to show that the animals "used" differential choice-point stimuli when they were available. This effect was present irrespective of the maze goal box color or the pretraining goal box color so that it could not be interpreted in terms of secondary reinforcement.

The results were discussed via Hullian theory and the overall adequacy of the experiment to test the theory. It was concluded that the experiment was adequate and that the results indicated a restriction in the generality of the concept of secondary reinforcement.

Microfilm copy of complete manuscript of 108 pages, \$1.35. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-797.

A THEORY OF DISCRIMINATION

(Publication No. 7503)

Frank Restle, Ph. D.
Stanford University, 1954

A mathematical theory of learning and transfer in the two-choice discrimination problem has been developed. Special consequences of this theory were found to correspond quite closely to empirical findings.

According to this theory the subject enters a discrimination problem with a set of hypotheses, some of which are relevant and some irrelevant to its solution. Learning is a dual process; the subject learns to reject irrelevant hypotheses and to identify relevant ones. On each trial the subject selects hypotheses randomly with replacement, identifying the relevant ones and rejecting the irrelevant ones. Each relevant hypothesis in the problem yields enough information on each trial to learn to reject or identify one hypothesis.

If an hypothesis is rejected in one problem it remains rejected in any later problem in which it is irrelevant. If an hypothesis is identified in one problem it remains identified in any later problem in which it is relevant.

On each trial the subject picks an "action hypothesis." If it is relevant and identified he responds correctly. If it is relevant but unidentified, or if it is irrelevant, he has only a chance probability of being correct. Rejected hypotheses are not used as action hypotheses.

The course of learning of a single problem depends only upon the proportion of relevant hypotheses. This proportion can be estimated from performance measures. Therefore the theory can be related to experimental fact.

It was shown that the theory in its present form can account for the general shape of the aggregate group learning curve. This is possible because the entire individual theoretical learning curve is determined if one knows the total number of errors made. Group average performance functions were constructed by making vertical averages of theoretical individual functions. The individual functions were chosen to agree with obtained total error scores reported in the experimental literature. The theoretical function agreed closely with obtained group average functions.

If two problems have the same irrelevant cues but entirely different relevant cues, a third problem can sometimes be constructed with the same irrelevant cues but with all of the relevant cues found in both of the first two problems. The theory makes it possible to predict performance on this third problem given the performance on the other two. Such a prediction was tested against published results and found to be accurate within reasonable limits of sampling error.

Other tests of the theory dealt with transfer of training between problems which involve the same physical dimension to be discriminated but which differ in difficulty. One case is where an easy

problem is learned, and performance is tested on a more difficult one. Transfer performance can be predicted from knowledge of the performance of naive subjects on the two problems. Two such predictions were tested against the results of rat experiments involving brightness discrimination, and a third was tested against the results of a new experiment using human subjects making a size discrimination. The predictions were quite accurate. The other case is where the difficult problem is learned first and then an easier one is learned. The theory predicted that a few errors, attributable to a "let-down," would occur. The prediction was compared with new data on human learning and was found to be quite accurate.

To investigate the axiomatic foundations of the theory an axiom set was devised from which the prediction theorems could be deduced. Rigorous mathematical proofs were given.

Microfilm copy of complete manuscript of 81 pages, \$1.01. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-798.

ELECTROCORTICAL ACTIVITY AND INDUCED BEHAVIOR DISORDERS

(Publication No. 7174)

David Rosenberg, Ph. D.
Vanderbilt University, 1953

Supervisor: Professor Gilbert W. Meier

The experiment reported was designed to test an implication of Hebb's formulation of emotion and neurosis. The theorem defined emotion as a brief disorganization of cortical timing and neurosis (and psychosis) as enduring disorganization. From this, the present writer hypothesized a change in the electrocorticogram following the induction of a neurosis in the cat which disappears concurrent with alleviation of the neurosis.

To lend operational rigor to this hypothesis, two partial definitions were constructed concerning: (a) induction of neuroses in animals and (b) the relationship of the electroencephalogram to timing phenomena in the cerebrum. The review of the literature included material bearing upon these definitions and physiological theories of emotion, experimental neuroses, and electroencephalography.

Electrodes were implanted in the skulls of nine experimental and six control animals. Electrocorticograms were obtained at three stages: (1) prior to induction of the neurosis, (2) during the state of neurosis, and (3) following alleviation of the neurosis. Equivalent time intervals were observed for the recordings from the control felines.

Comparisons of the mean electrocorticogram frequencies were made between the stages of the experimental group and between the experimental and control groups at the second phase of the procedure.

Data germane to the range of frequency and amplitude of the records were evaluated.

In these comparisons, no changes were detected in frequency, amplitude, or pattern in the recordings at the various stages. Hence, the results clearly indicated that the hypothesis derived from Hebb's theorem has not been confirmed. The theorem that neurosis is a disturbance of timing may be seriously questioned.

The findings and their ramifications were discussed relative to other physiological theories of emotion, in particular to Arnold's notion of excitability of the frontal lobes and Lindsley's concept of "activation pattern."

A revision of Hebb's theorem was proposed to more adequately account for the results of this study. It was maintained that whereas emotion is a disruption in cortical timing, neurosis is not. The neurosis is a state of cortical organization in which the earlier disruption has become harmonious through continued firing of certain neural cells.

Research projects pertinent to problems within this area were enumerated.

Microfilm copy of complete manuscript of 107 pages, \$1.34. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-799.

A STUDY OF FIGURAL EQUIVALENCE IN THE PIGEON

(Publication No. 7204)

Arnold Lester Towe, Ph. D.
University of Washington, 1953

This experiment concerned the nature and extent of transfer of an acquired visual figure

discriminatory response in the pigeon, and was designed to yield an overall figural equivalence score for each subject and an equivalence measure for each member of a pair of testing figures as they relate to the original training figures. Twenty-four pigeons were trained to peck a triangle and to avoid a square, when they were presented simultaneously in a free-field training box especially constructed for use with birds. Subsequently, forty pairs of testing figures, consisting of variations from the original training figures with respect to the stimulus dimensions of rotation, cue reduction, size, distortion, and brightness, were presented.

The extent of response transfer found in the pigeon was as great as (or greater than) that found in the mammal in similar situations. This differential response had its basis in an adient response to the triangle, and neither avoidance of the square nor response on the basis of relational properties were implicated. This adient response was not to the class-form, triangle, or to the specific-shape of the triangle. The pigeons failed to transfer to rotated figures, and showed a marked preference for the larger of two visual figures. Some pattern changes disrupted the differential response. An hypothesis is advanced to account for the extensive transfer to the other testing figures, involving an hierarchy of response tendencies to various aspects of the triangle.

Microfilm copy of complete manuscript of 73 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-800

RELIGION

THE SYNTAX OF THE GREEK ARTICLE: ITS IMPORTANCE FOR CRITICAL PAULINE PROBLEMS

(Publication No. 7171)

Robert Walter Funk, Ph. D.
Vanderbilt University, 1953

Supervisor: Professor Kendrick Grobel

This study is based on the tenet that the Greek article is important for syntactical, stylistic, and exegetical studies. It seeks to enhance this point of view by applying the rules governing the syntax of the article to major problems in the Pauline corpus.

Recent scholars have suggested that the question of the integrity of the individual Pauline letters should be decided in the full light of grammatical data. The analysis of the Pauline use of the article

is the first step in making available pertinent data for this purpose.

But it is valuable also for questions of exegesis and text. The article is a tool to be utilized in obtaining nuances of meaning. Often the full significance of a phrase is lost simply because there has been an oversight with respect to the article.

Each textual critic knows that it is wise to employ as many scientific aids as possible in making choices between variants. The established patterns of articular usage of Paul can often be utilized in this connection.

The approach here made is that of examining, first of all, the recognized rules governing the use and non-use of the article. At points it is necessary to revise and correct standing principles. This is done in order to make organization of the Pauline materials easier.

The second step is a detailed survey of the

Pauline materials with two specific norms in mind: the normal usage in koine, especially the New Testament, and the Apostle's own predominant construction. It is to be recognized that in most cases these two norms merge.

In the course of the analysis, variants, unique constructions, and idiomatic expressions are carefully noted. Variant may denote two things. It may signify a usage which is outside the normal pattern of the koine period. It may also mean a deviation from the established usage of Paul. It is the latter that is important for the purposes of this study, but the former may be utilized to determine Pauline style and idiom where it differs from ordinary Greek.

In arriving at these individual decisions, several canons are followed: first, only relative consistency is claimed for Paul, and this particularly with reference to unconscious patterns rather than conscious affectations. Secondly, vacillation within a context carries much more weight than deviations widely separated. The letters as integral compositions or the smaller divisions of composite letters (like II Corinthians) are kept in mind. In the final analysis all decisions about the authenticity of specific usages are tentative. Many verses designated "marginal" in light of a particular phenomenon

cannot be seriously denied to Paul in the light of the overall picture.

Suggestions are made with regard to textual problems and exegetical questions at the points where the evidence is especially applicable.

A graphic representation of the distribution of grammatical variants based on the analysis of the article reveals that, in comparison with the critical evaluation of the Pauline materials made by R. M. Hawkins, the strictly grammatical approach does not universally substantiate his theological approach. On several verses they do converge: Romans 9:5b; I Corinthians 7:14, 34; II Corinthians 5:19; Galatians 6:7, 8; Philippians 3:20; I Thessalonians 1:10. Strong grammatical evidence indicates that additional materials, contrary to Hawkins' view, are probably non-Pauline.

The results of this study are both tentative and incomplete. A complete grammatical analysis coupled with the fruits of form and textual criticism will provide the only sound solution to the problem of integrity.

Microfilm copy of complete manuscript of 281 pages, \$3.51. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-801.

SOCIAL PSYCHOLOGY

ADOLESCENT ROLE RELATIONSHIPS IN THE DYNAMICS OF PREJUDICE

(Publication No. 7160)

Dean George Epley, Ph. D.
Michigan State College, 1953

Statement of the Problem

The purpose of this study was: (1) to describe the expression of attitudes toward Jews and Negroes, as well as the change in these attitudes, by the adolescent population of a rural Midwestern community; (2) to analyze the relationship between these attitudes and various social roles played by adolescents in reference to parents, peers, and teachers; and (3) to develop an instrument for the measurement of orientation toward these reference groups which might be fruitful for other aspects of role analysis. Analysis was guided by the hypothesis that differences in the expression of attitudes toward minority groups are a function of differences in role orientation among the members of a given group.

Method of Procedure

Data were collected by means of a group-administered questionnaire given to sixth and ninth grade students in 1949, and to the same students again in 1952. There were 332 students for whom data from both questionnaires were available. Responses to six Jewish and six Negro statements in each ques-

tionnaire were scored to provide Jewish and Negro Prejudice Scores respectively. Change in Prejudice Scores were determined by a comparison of 1949 and 1952 Prejudice Scores for each student. Orientation toward the three reference groups of parents, peers, and teachers was established on the basis of certain self-images of the students of their role relationships. Orientation toward peers was further considered on the basis of sociometric status as friendly and as seatmate. The significance of categorical differences in orientation and the expression of prejudice was tested by chi-square and analysis of variance.

Findings of the Study

The major conclusion warranted by the data was that adolescent attitudes toward Jews and Negroes were relatively favorable and became increasingly so. Although the students as a whole became more tolerant of both minorities, the general level of sentiment toward Negroes continued to be less tolerant than that expressed toward Jews. Over 40 per cent of all students changed their attitudes during the period studied. This indicates that prejudice may be modified for some people since it does not seem to be fixed in the basic personality of all adolescents.

There was only slight evidence that youth-parent role relationships were related to the degree of prejudice expressed in 1952, or to change in prejudice from 1949 to 1952. There was no evidence that

peer group roles, as determined by either self-images of relationships with peers or by sociometric choice or rejection of classmates, was related to the expression of prejudice toward either Jews or Negroes. There was no evidence that peer group roles affected changes in expressed attitudes.

Significant differences in support of the hypothesis were found in the case of student-teacher relationships. Students who were positively oriented toward teachers were significantly more tolerant, or became significantly more tolerant, of Jews and Negroes than students who were negatively oriented toward teachers. Teachers thus appear to occupy strategic positions as action agents in the implementation of programs designed to change existing attitudes.

Microfilm copy of complete manuscript of 220 pages, \$2.75. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-802.

THE EFFECTIVENESS OF SOCIAL GROUP WORK IN THE DEVELOPMENT OF QUALITATIVE PARTICIPATION

(Publication No. 7181)

Helen Northen, Ph. D.
Bryn Mawr College, 1953

The purpose of this study was to ascertain to what extent individuals are helped by social group work methods to participate responsibly in groups and to develop their capacities for democratic leadership. Pre-project questionnaires providing data about the members of groups, follow-up interviews with members, and narrative process records of groups were the primary sources of data. The research procedures consisted essentially of three steps: (1) measuring, by use of a participation scale, the amount, kind, and quality of participation and the net amount of change in quality of participation occurring during four months for 102 members of sixteen different groups sponsored by a settlement; (2) measuring, by means of a group work service evaluation scale, the quality of group work rendered to the sixteen groups; and (3) determining the extent to which quality of participation and change in quality of participation were associated with quality of group work service and with other relevant factors.

In order to understand better the relationship between participation, democratic leadership, and social group work skill, several specific hypotheses were formulated and tested. The quality of an individual's participation in groups was found to be a measure of his leadership in the group. As measured by the participation scale, democratic leadership was distinguished from domination or coercion. Quality of participation was spread over a range of constructive, passive, and destructive behavior manifestations; it was not associated to any significant extent with quantity of participation, type of group,

or age range of members. The assumption that qualitative differences in the application of group work principles by group workers can be identified and quantified was supported. Skill in social group work was increased by education in schools of social work and past experience in group work, with education a better predictor of success in the practice of group work than experience.

In considering the relationship between the quality of group work service and the quality of member participation, the amount of positive or negative change that occurred in the groups was not correlated with skill in social group work. Several factors related to the nature of participation, the relatively short time span, inability to control the level of the groups at the beginning of the project, and the relatively high average quality of group work seem to explain this negative finding. On the other hand, there was considerable evidence to support the hypothesis that social group work helps individuals to participate responsibly in groups and to develop their capacities for democratic leadership. High quality of social group work service and high quality of participation were positively correlated to a substantial extent. In general, in those groups in which the most skilled group work was used there also was the highest quality of participation. Other factors that might have influenced the results such as type of group and age range of members were related neither to quality of participation nor to quality of group work. Members who had the most experience in groups, as measured by their attendance, had the highest quality of participation. There were more significant gains than losses in quality of participation by members. From the standpoint of the members' own evaluations, 93 per cent believed they had been helped through these particular group experiences.

Suggestions for further research, copies of the schedules and scales used in the project, full process records of the groups ranking highest and lowest in social group work skill, and a selected bibliography are included in the dissertation.

Microfilm copy of complete manuscript of 255 pages, \$3.19. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-803.

THE CONSISTENCY OF SOCIAL CONFORMITY BEHAVIOR

(Publication No. 7172)

Roderick Francis O'Connor, Ph. D.
Vanderbilt University, 1953

Supervisor: Dr. Arthur Canter

The study was designed chiefly to test the hypothesis that social conformity behavior tends to manifest itself in a consistent manner, in any one individual, in diverse situations. It was also hypothesized that conformity behavior bears an

inverse relationship to level of manifest anxiety and a direct relationship to rigidity.

Conformity was defined as those responses of the individual which demonstrate acceptance of the standards or norms of the group with which the individual is interacting.

One hundred forty students in undergraduate classes in psychology, sociology, and anthropology were used as subjects.

To test the main hypothesis, five measures of conformity were used: an attitude scale of conformity, two behavioral conformity measures, a figure-preference test, and ratings of conformity by instructors.

As a measure of anxiety the Taylor Manifest Anxiety Scale was used. Forty-two items from the Wesley Rigidity Scale comprised the measure of rigidity.

The following results were obtained:

1. Four of the conformity measures were found to have sufficient reliability to warrant investigation. The fifth, one of the two behavioral measures, was lacking in reliability and received no further statistical treatment.

2. The four reliable conformity measures were found to be significantly related to each other in the hypothesized directions. In addition, factor analysis indicated the presence of a common, or general factor among the conformity measures. None of the relationships was found to be sufficiently high, however, to permit predictability (the Pearson coefficients of correlation ranged from .151 to .408).

A factor analysis of the five sub-scales which comprised the attitude scale gave further evidence of a common factor of conformity.

No significant correlations were obtained between the Manifest Anxiety Scale and the four conformity measures. There was some evidence, however, that the most non-conforming subjects tended to be either significantly above or significantly below the average in adjustment as measured by the Anxiety Scale.

Scores on the Rigidity Scale were related in the hypothesized direction to all four measures of conformity. Two of these correlations were significant. Scores on the four conformity measures were converted to standard scores and the averages of these standard scores were correlated with scores on the Rigidity Scale. A highly significant relationship (.001 level) was found.

The attitude scale was re-scored for extremity of attitude. In other words those showing extreme attitudes, either in the conforming or non-conforming direction, occupied the upper end of the scoring continuum. No relationship was found between this measure of extremity of attitude and either rigidity or anxiety.

No relationship was found between the Anxiety and Rigidity Scales.

The following conclusions were drawn:

1. Social conformity was found to be a consistent behavior tendency, at least in the present population. This result provides evidence that social conformity, when viewed as a consistent personality characteristic,

is a valid and useful intervening variable in accounting for the relationship between antecedent conditions and the subsequent behavior of individuals.

2. Level of manifest anxiety does not bear a simple relationship to social conformity. Rather, the relationship appears to be more complex, with non-conformity stemming from either exceptionally good or exceptionally poor adjustment.

3. Rigidity, at least as measured by the Wesley Rigidity Scale, is directly related to social conformity behavior.

4. Extremity of social attitude, as a behavioral dimension, is related to neither rigidity or manifest anxiety.

5. Recommendations were made for further research in the area of social conformity behavior.

Microfilm copy of complete manuscript of 124 pages, \$1.55. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-804.

CERTAIN DETERMINANTS AND CORRELATES OF AUTHORITARIANISM

(Publication No. 7510)

Sidney Siegel, Ph. D.
Stanford University, 1954

A survey of the theoretical and research literature culminated in the derivation of five general hypotheses about correlates of authoritarianism. The variables considered as behavioral correlates of authoritarianism were (1) manifest anxiety, (2) intolerance of cognitive ambiguity, (3) stereotyping, (4) "high status" orientation, and (5) identification-compulsion.

A random sample of 100 freshman women students at Stanford was taken; ninety-nine of these served as subjects. Each subject took five objectively scored tests and also participated in a secret ballot by which she indicated her university residence choice for the following year. (This balloting is a university procedure in which all freshman women take part.)

The data were subjected to two kinds of statistical analysis: (1) a "t" for the difference between the mean "E-F" (authoritarianism) scores of those characterized as "high" on any of the above five variables and those characterized as "low" was found, and (2) the appropriate correlation coefficient was found expressing the relation between the variable in question, as measured, and authoritarianism.

In all five experiments the operational definition for authoritarianism was the Berkeley "E-F" scale.

The hypotheses and results of the experimental tests of them follow:

Hypothesis I: Anxiety is a correlate of authoritarianism.

Anxiety was operationally defined by the Taylor Manifest Anxiety Scale.

The results supported the hypothesis as formulated, yielding a $t = 3.00$, $P < .002$. The correlation was, $r = .25$.

Hypothesis II: Intolerance of ambiguity is a behavioral correlate of authoritarianism.

Tolerance-intolerance of ambiguity was operationally defined by a test especially designed for this study.

The results supported the hypothesis as formulated, yielding a $t = 4.42$, $P < .00001$. The correlation (contingency coefficient) was, $C = .40$.

Hypothesis III: Stereotyping is a behavioral correlate of authoritarianism.

Stereotyping was operationally defined by a test especially designed for this study.

The results supported the hypothesis as formulated, yielding a $t = 3.55$, $P < .0002$. The correlation was $r = .40$.

Hypothesis IV: "High status" orientation is a behavioral correlate of authoritarianism.

"High status" orientation was operationally defined by the residence choices indicated by the subjects in the secret ballot mentioned above. (A poll of a representative group of students was first taken to establish a high-to-low status distribution of available residences.)

The results supported the hypothesis as formulated, yielding a $t = 2.85$, $P < .003$. The correlation (biserial) was, $r_b = .36$.

Hypothesis V: Compulsion to differentiate and to recognize members of the ingroup and outgroup as such is a behavioral correlate of authoritarianism.

Identification-compulsion was operationally defined by a test especially designed for this study.

The results supported the hypothesis as formulated, yielding a $t = 3.56$, $P < .00002$. The correlation (biserial) was, $r_b = .43$.

The rationale underlying each of the experiments, and the operational definitions involved, were discussed, as were the results and implications.

An integrated understanding of the findings was attempted which included some *ad hoc* intercorrelations. The necessity of extending the theoretical and experimental schema, and directions for future theorizing and experimentation were discussed.

Microfilm copy of complete manuscript of 120 pages, \$1.50. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-805.

FACTORS ASSOCIATED WITH THE COMPATIBILITY OF ROOMMATES: A TEST OF THE BIRDS-OF-A-FEATHER HYPOTHESIS

(Publication No. 7274)

Robert Gordon Zumwinkle, Ph. D.
University of Minnesota, 1953

The study tested the hypothesis that compatibility of roommates is a function of homogeneity of the characteristics of the roommates. The subjects consisted of eighty-five pairs of roommates; 170 women in the freshman residence hall at the University of Missouri.

A scale of ninety-eight true-false items was devised to measure roommate compatibility and was administered to each subject. The index of compatibility for each roommate pair was derived by summing the two logarithmically transformed scores of the two roommates. The compatibility scale was found to have a satisfactory degree of internal consistency by the use of Hoyt's method ($r = .91$) and to have adequate validity as determined in three ways: intraclass correlation between roommates, validating against the results of a sociometric question, and validating against the judgment of dormitory counselors.

The test of the birds-of-a-feather hypothesis was limited to the following factors: the personality characteristics (individual scales and total profile) measured by the Minnesota Multiphasic Personality Inventory, the interest patterns on Strong's Vocational Interest Blank for Women, avocational interests indicated by responses to Parts II and III in the Strong, academic aptitude (A.C.E. Psychological Examination), academic achievement (grade-point average), college in which enrolled, chronological age, religious preference, size of hometown, educational level of parents, sorority or non-sorority status, part-time employment status, height, and weight. Evidence supporting the hypothesis came from four factors: the Sc, Si, and Pt scales on the MMPI, and the MMPI profile. Evidence tending to support the opposing hypothesis that heterogeneity is associated with compatibility was found in connection with the following three factors: avocational interests, college affiliation, and the Mf scale of the MMPI. Roommate compatibility was not significantly associated with homogeneity in the remaining twenty characteristics.

It was concluded that the preponderance of evidence indicated that the hypothesis was lacking in validity in the setting in which the investigation was conducted.

Microfilm copy of complete manuscript of 182 pages, \$2.28. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-806.

SOCIOLOGY

SOCIOLOGY, GENERAL

A COMPARATIVE STUDY OF NON-TRUANT AND TRUANT CHILDREN

(Publication No. 7214)

Joseph Andriola, Ph. D.
University of Minnesota, 1953

A review of the literature of the past 30 years revealed two salient facts: (a) a paucity of objective studies dealing with truancy and, (b) a lack of agreement regarding not only the causes and treatment of truancy, but also regarding its definition. The major points of view expressed were:

1. Truancy is a result of complicated psychological problems within the truant child.
2. It is the first step in a subsequent criminal career.
3. It is caused by poverty, broken homes, employment of mothers outside the home and undesirable neighborhoods.
4. It is caused by maladjusted teachers and/or an ill-suited curriculum.
5. Truants and other delinquents are indistinguishable from non-truants or non-delinquents.
6. The phenomenon of truancy can only be understood if one also understands the cultural influences operating in society.

In this research an effort is made to find whether or not there are observable and measurable differences between non-truant and truant children in the sample studied. The major hypothesis tested is:

There are no significant differences in certain variables to be measured in matched samples of non-truant and truant children.

Eighty matched pairs (50 pairs of boys and 30 pairs of girls), each pair consisting of a non-truant (control) and truant (experimental) child enrolled in the San Bernardino High School of San Bernardino, California were studied during the academic year 1951-52. Matching factors were: sex, age, grade, race, and school. The dependent variable was the status in respect to truancy. The control and the experimental groups were compared with respect to the following eight independent variables: intelligence quotient, self adjustment, social adjustment, total adjustment, scholastic achievement, paternal occupation, possession of telephone, marital status of parents.

Intelligence test scores were obtained from existing school records. Measures of self adjustment, social adjustment and total adjustment, were based upon scores achieved by each child on the California Test of Personality - Secondary Series. A measure of socio-economic status was obtained by the use of the Minnesota Scale of Paternal Occupations. Scholastic achievement was based upon school

marks and grade points received by the children. Separate calculations were made for academic and non-academic subjects on each of the above two items.

In the statistical analysis of the data, essentially two approaches were used. First, differences between the means of the control and experimental groups on various independent variables were tested for statistical significance. Second, a correlational approach was used in which the degree of the inter-relationship between selected pairs of independent variables and the relationship between independent variables and the dependent variable (truancy) was evaluated. Separate analyses were made for the two groups of boys and for the two groups of girls.

The study revealed that the principal hypothesis, that there are no significant differences between non-truant and truant children tends to be strongly supported. The only independent variable providing a large degree of prognostication of truancy status was that of scholastic achievement - non-truants rated considerably higher than truants. It is difficult to judge whether a low level of scholarship is a necessary consequence of truancy or whether truancy is dependent upon poor scholarship.

Microfilm copy of complete manuscript of 105 pages, \$1.30. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-807.

URBANISM AND DEPENDENCY: A TEST OF A CERTAIN VALUE THEORY IN RURAL SOCIOLOGY

(Publication No. 7498)

Harry Vincent Kincaid, Ph. D.
Stanford University, 1954

This research is designed to test the validity of the hypothesis that rates of dependency are significantly higher in 1940 and 1950 in urban than in rural counties of California and Pennsylvania.

Statistics on dependency are related to a segment of rural sociological theory concerning differential value orientations of rural and urban populations. More specifically, dependency statistics are related to rural-urban differentials with regard to the value of socio-economic self-reliance or independence. A recent work in the field of rural sociology by Loomis and Beegle (*Rural Social Systems*, Prentice-Hall, 1950) is selected as a current synthesis of the contemporary views of rural sociologists with respect to rural urban value differentials.

Loomis and Beegle, using the ideal typical method, indicate that social organizational factors lead to the conclusion that values of socio-economic self-reliance control behavior to a greater degree in

rural than in urban social systems. Certain historical evidence and research findings, according to these authors, support this proposition. From the framework presented by Loomis and Beegle, it appears to follow that, rates of dependency should be significantly higher in urban than in rural areas.

For the purpose of testing the validity of the foregoing conception of rural-urban differentials in the value of socio-economic self-reliance, statistics of public assistance for the states of California and Pennsylvania are related to the index of urbanism developed by Queen and Carpenter (*The American City*, McGraw-Hill, 1953). The analysis is made for the years 1940 and 1950 for three types of public assistance, namely, old age assistance, aid to needy children (aid to dependent children in Pennsylvania), and general relief (general assistance in Pennsylvania). The correlations between dependency and urbanism are refined by holding a measure of socio-economic rank constant. Thus, for each county of each state in 1940 and 1950 correlations are given between each of the various types of public assistance and urbanism with socio-economic rank held constant.

In general, rates of dependency are higher in rural than in urban counties of both California and Pennsylvania. In regard to old age assistance for both states in both years the results are in direct opposition to the hypothesized relationship. In every case, both the zero order correlation coefficients between old age assistance and urbanism and the partial correlation, with socio-economic rank held constant, are negative and significantly different from zero. In other words, recipient rates for old age assistance are significantly higher in rural than in urban counties of both California and Pennsylvania.

In regard to aid to needy (dependent) children and general relief (assistance) there is little relationship with urbanism either as zero order correlations or as partial correlations, with socio-economic rank held constant. While these correlations are not statistically significant, the fact that recipient rates for these types of public assistance tend to be higher in rural than in urban counties supports the rejection of the hypothesis that rates of dependency are significantly higher in 1940 and 1950 in urban than in rural counties of California and Pennsylvania.

An analysis of the data indicates that the factor of administrative policy of county departments of public assistance might be useful in explaining the observed variation in rates of dependency between counties. Within the limits imposed by the methods and data, it is suggested that the variable of administrative policy could be considered an intervening variable operating between urbanism and dependency rates.

Microfilm copy of complete manuscript of 128 pages, \$1.60. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-808.

INTERMARRIAGE BETWEEN DIVERGENT ETHNIC GROUPS AS AN INDEX OF ASSIMILATION

(Publication No. 7470)

Michael Edward Kolivosky, Ph. D.
Michigan State College, 1953

This is a case study of interethnic assimilation, with primary focus on intermarriage, between Slovaks and Swedes in Grassflat, a rural non-farm community in central Pennsylvania. The particular value of this study, in terms of its purpose, lies in the discovery of unique ways by which two divergent ethnic groups participated in an assimilative process in which they had been engaged for more than six decades.

The major portion of data was gathered by individual interviews, questionnaire, and tape-recorded interviews with selected groups of Slovak and Swedish residents of the first, second, and third generations. Personal diaries, church records, ledgers of local organizations, correspondence with selected residents, and a survey (census) of the community were additional sources of information. Only a limited number of documentary sources were available, and they were consulted. In short, the sources of data were very largely field, rather than documentary. Almost all of the data were gathered by the writer who worked as a participant observer in the community which was studied.

In 1951 the population of Grassflat was 784. Of this total, 49% were Slovak, 27% Swedish, 23% "other nationalities" (neither Slovak nor Swedish), and 2% Slovak-Swedish. Classified according to religion, 54% were Catholic, 32% Lutheran, 7% other Protestant, and 7% claimed to be members of no church.

Employment opportunities in the coal industries of Pennsylvania attracted Slovaks and Swedes to this country during the latter decades of the 19th and beginning decades of the 20th Centuries. Swedes emigrated from the vicinity of Dalsland, Sweden, and Slovaks from in or near Presov, Slovakia. Immigration of Swedes antedated that of Slovaks by approximately two decades. Immigration to Grassflat was more direct by Slovaks than Swedes.

What has happened in the assimilation between Slovaks and Swedes in Grassflat can be presented in terms of four major developments: First, living in relative isolation during the first decades, Slovaks and Swedes demonstrated an accentuation of their respective native cultures by developing parallel organizations. Second, interethnic assimilation was strongly facilitated by both the public school where they learned a common language and experiences which they shared in the coal industry. The United Mine Workers Union, of which both Slovak and Swedish miners were members, was also an important agency through which they solved mutual problems. Third, with the mobility of residents, especially Swedes, to urban centers between 1925 and 1935 after the coal mines closed, the Slovak population became numerically larger, Swedes began to participate in

Slovak activities, and residential segregation decreased as Slovaks and Swedes moved into sections formerly occupied by exclusively one or the other ethnic groups. Fourth, as the number of interethnic contacts increased, not only was diffusion of native cultural patterns promoted, but new patterns were developed. Probably most important were clubs (taverns) and social organizations which admitted all residents.

A study of all marriages contracted by Slovaks and Swedes, both residents and former residents – including 109 Slovak males, 119 Slovak females, 86 Swedish males, and 73 Swedish females – indicated that only seven Slovak-Swedish marriages occurred between 1922 and 1951. All Slovak-Swedish marriages, except one in which a Swedish woman converted to Catholicism, were mixed religious marriages. In all seven marriages the children were reared Catholic.

Data supported the following hypotheses regarding Slovak and Swedish populations in Grassflat. One, the factor of religion is more important in precluding intermarriage than other aspects of ethnic background. Two, the degree of cultural solidarity within a particular ethnic group to a large extent determines the rate of exogamy of its members, that is, the greater the degree of cultural solidarity the lesser the rate of exogamy of its members. Three, the rate of intermarriage with other religious and nationality groups by both Slovaks and Swedes tends to increase with their mobility to urban areas. Data were insufficient to support or disprove the hypothesis that the rate of intermarriage between Slovaks and Swedes is greater among the upper and lower economic classes, as defined by residents in the community, than the middle class.

Microfilm copy of complete manuscript of 108 pages, \$1.35. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-809.

**A COMPARATIVE ANALYSIS OF THE
DECISION-MAKING PROCESS IN
COMMUNITY ORGANIZATION TOWARD
MAJOR HEALTH GOALS**

(Publication No. 7165)

Paul Ausborn Miller, Ph. D.
Michigan State College, 1953

The study developed from two major needs of present research in community organization and action. The first was an insufficient attention in the past to comparative data on community action; and the second was the difficulty of relating community processes to larger sociocultural systems such as the state, region, and nation. For this reason, the design and the analysis employed the mailed questionnaire to elicit quantitative data on community action, and employed the case study to elicit comparable qualitative data.

The investigation focused on community behavior

in one class of communities, or communities relatively limited in population and resources, in which those resources were mobilized and organized in the achievement of a major and specific health goal. The goal was that of the hospital. The body of data was the reports of 218 hospitals in the United States, constructed since 1946 with assistance by federal funds, and which were located in municipal sites of not more than 7500 population.

The problem of the study was one of introducing the perspective of the political process into a community organizational context. This perspective was defined and conceptually developed as the decision-making process. The major hypothesis was that some decision-making processes function on the basis of authority, others function on the basis of influence, and that community situation together with an understanding of higher levels of integration such as the region are among the determinant factors. The analysis dealt with the applicability of two major concepts, authority and influence, to an understanding of the comparable differences in the decision-making process in six regional areas of the United States, the Northeast, the Southeast, the Southwest, the Middle States, the Northwest, and the Far West.

The analysis provides the conclusion that the authority-influence differential does occur in regional groupings of hospital construction projects. Although the incidence of county governing bodies was associated with each regional grouping, with the exception of the Northeast region, certain contrasts occurred. The hospital projects of the Southeast, the Southwest, the Middle States, and the Far West, more commonly exhibited the participation of civil governing officials, encountered a relatively less number of community-oriented problems, utilized relatively fewer communication media and appeals, and met with relatively greater success with one fund-raising campaign. The hospital projects of the Northeast and Northwest regions did not commonly exhibit the participation of civil governing officials, encountered a relatively greater number of community-oriented problems, more commonly utilized communication appeals and media, and met with relatively less success with one fund-raising campaign.

When the incidence of political elements increased in regional groupings of hospital projects, the problems of community organization diminished, the use of communication media and appeals decreased, but initial success was greater with one fund-raising campaign. The hospital projects sponsored by civil governing officials with authority for hospital construction were relatively more decisive in accomplishing the hospital goal, although participation by local people and attention to communicating and appealing to the community was reduced. The voluntary hospital projects, sponsored outside the jurisdictions of civil governing officials, offered the reciprocal profile.

Microfilm copy of complete manuscript of 547 pages, \$6.84. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-810.

SOCIOLOGY, FAMILY

A STUDY OF THE APPLICABILITY OF
SELECTED MARITAL SUCCESS CRITERIA
IN CERTAIN POPULATION GROUPS

(Publication No. 7237)

Arthur LaVerne Johnson, Ph. D.
University of Minnesota, 1953

Purposive samples were obtained and data collected from anonymous questionnaires. To avoid quantitative assumptions, statistical techniques consisted primarily of median ranks, percentages, chi square tests, and Guttman scale analysis.

Sources of Data

A four page questionnaire was constructed to test the variability of opinions and beliefs relative to selected marital success criteria. The questionnaire contained 71 opinion-belief items of five varied types, plus 35 conventional background items such as age, sex, education, etc. Thirteen study groups were utilized, ranging in size from 20 to 92, and totalling 501 respondents. An additional 140 respondents were used for partial scale validation. The study groups consisted of six unmarried college student groups, three of each sex, and seven married groups of which two were student groups. These groups varied in internal homogeneity on a number of factors, including age, education, occupational level, and religion.

Analysis of Data

First an item analysis was made separately for each group to compare the variability of item responses within and among study groups. Secondly, the Guttman scale analysis technique was employed to test patterns of response consistency of individuals within each study group in four limited content areas related to marital expectations: religious agreement, sex fidelity, divorce grounds-response, and divorce grounds-institutional functions. Thirdly, all respondents were regrouped into a combined scale classification pertaining to the meaning

and permanency of marriage and the importance of religious agreement. Chi square tests of independence were made for each questionnaire item to test the hypothesis of differential applicability of selected marital success criteria.

Major Findings

1. Significant variability of marital role expectations was found within and among the thirteen study groups, with consistently contradictory directions in marital expectations found between two groups selected on the basis of religious homogeneity, a Lutheran couples club and an Unitarian student group.
2. Incipient Guttman scales were constructed in four content areas, based on a limited number of items in each area, with reproducibility coefficients ranging from .88 to 1.00 for individual groups and from .92 to .96 for combined groups.
3. Substantial verification was found for the hypothesis that permanency of marriage was differentially valued among respondents.
4. Specific objective functions relating to marital roles were highly valued in marital expectations, though relatively unexplored in this study and in extant success criteria.
5. Success criteria items relating to spousal agreement or conflict showed variability of content areas having applicability and in expectations regarding degrees of agreement.
6. Individual and group differences were found regarding the importance of personal happiness and possible factors instrumental in subjective happiness ratings.

Implications for Research

The major implication for research is the need for extending knowledge and measurement of marital role expectations, their interrelationships and consequences for behavior if marital success criteria are to have widespread applicability.

Microfilm copy of complete manuscript of 307 pages, \$3.84. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-811.

SPEECH — THEATER

AN ANALYSIS OF VALUE JUDGMENTS
IN SELECTED SECONDARY SCHOOL PLAYS

(Publication No. 7217)

Arthur Harold Ballet, Ph. D.
University of Minnesota, 1953

The nine most frequently produced plays during 1950-1951 in secondary schools having National Thespian Society affiliation were selected as the

basis for the study. From these plays, a list was compiled of all the possible assumptions, attitudes, and ideas which the author believed the plays to contain. Irrelevant and duplicate items were eliminated. The presence of these value judgments in the plays was confirmed by having expert and qualified judges read the plays and indicate which of the assumptions they believed to be present. All items were eliminated on which the writer and the judges did not agree as present in the plays.

The confirmed list of 126 assumptions was semantically checked so that it was clear and understandable for those who were to be asked to react to the questionnaire. The items were then submitted to a limited sample of high school students, parents, and faculties from two Minneapolis schools. These groups were requested to indicate on a scale how true they believed each assumption to be and how acceptable in a high school play they believed each assumption to be.

The complete range of responses was computed numerically and by percentages for each tested group. A comparison was made for significance of the extreme responses of True and Acceptable with Untrue and Unacceptable for the three groups. The average responses of Truth and Acceptability were also computed for each of the two schools examined and for the combined populations.

Certain elements of characterization, plot, and dramatic structure which all of the plays share were discussed. The plays were found to be strikingly similar in most respects.

Significant differences in the kinds of responses were found on a number of items. Those items dealing specifically with adolescent behavior most frequently elicited significantly different responses from the student groups and the parent-teacher groups.

Whenever there was an inclination in either the direction of true-acceptable or untrue-unacceptable in the response to the item, the three groups generally ranged themselves in a fairly regular pattern with the students less extreme than the parents and the faculty more extreme than either the parents or the students. This same tendency toward extreme responses was found to be more frequent for one of the schools, University High School, than for the other, Marshall High School.

Although it must be granted that the items may have tended to be weighted by the biases of the author, most of the items were rejected as untrue and unacceptable by the persons responding. While this rejection may be based on a desire on the part of the tested group to complete the items in a way which they thought was expected of them rather than as they truly felt, it must be assumed that this is not true inasmuch as they had nothing to gain by such falsification. That more items were rejected than were approved has been interpreted as a rejection of many of the value judgments in the plays studied.

Contrary to the apparently prevalent idea that high school plays are "just comedies" without any important or serious ideology, the nine plays studied, in the opinion of the author and of the judges who validated the questionnaire, do contain certain assumptions, ideas, and/or attitudes. While it would not be possible to pass moral judgment on these assumptions, the students, teachers, and parents who were questioned seemed to have agreed with the author and the judges in this by their general rejection of the majority of the items.

Microfilm copy of complete manuscript of 632 pages, \$7.90. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-812.

THE ORDINAL POSITION EFFECT IN RADIO AUDIENCE RESEARCH

(Publication No. 5456)

Samuel Leo Becker, Ph. D.
State University of Iowa, 1953

Statement of the Problem

The purpose of this study was to determine whether the radio program types which respondents to a survey select as their favorites are influenced by the order in which the sixteen types are arranged on a check list.

Methodology

Two of the many studies which use this check list in the United States and other countries were utilized as a means of collecting data for this investigation. These were the 1952 Iowa Radio-Television Audience Survey and The Kansas Radio-Television Audience of 1952 survey.

When the interviewers for these surveys reached the question on program types preferences, they handed each respondent a list of the sixteen program types: Classical or Semi-Classical Music, Complete Dramatic Shows, Talks and Discussions of Important Public Affairs, Comedians, Livestock and Grain Market Reports, Old-time Pioneer or Western Music, Daily Continued Serial Stories, Home-making Programs, Variety Programs without featured Comedians, Talks on Farming and Farm Problems, Popular Music and Popular Orchestras, Broadcasts of Sports Events, Hymns or Religious Music or Devotionals, Quiz or Audience Participation Programs, News Broadcasts, and Brass Bands.

As the respondent was handed a list of program types, he was asked "Of the types of radio programs listed below, which FIVE do you like best? Please name exactly five - no more." This was also printed at the top of each form.

Sixteen forms of the check list were made up, with each program type listed once in each ordinal position, and preceding and following every other program type once. Each succeeding respondent was given a different check list form with every seventeenth respondent receiving the same one. The subjects were selected with a stratified-random method.

15,953 personal interviews were utilized in this analysis. Analysis of variance techniques were utilized to evaluate the effect of ordinal position. The group was first analyzed as a whole for any ordinal position effect, then broken down in the following three ways and reanalyzed for each: sex, age (21-35, 36-50, Over-50), and education (Attended College, Attended High School, Attended Grade School).

For each analysis, the number of subjects from each state responding to each form was "corrected" so that the total number of choices made by each of these subgroups was the same. Each of these subgroups was treated as one subject in the analysis so that the data approached continuity.

Results

The principal findings may be summarized as follows:

1. In general, the later on a check list a program type appeared, the less chance there was that the respondent would select that type as one of his five favorites.
2. Different program types did not appear to be affected equally by ordinal position. This was concluded, though, to be due to sample size more than to basic differences in response.
3. For every program type in every breakdown, a greater proportion of choices were received in the first eight ordinal positions than were received in the last eight.
4. There appear to be no major differences in order effect between men and women, between the three age groups, or between the three education groups.
5. No statistical tests were made of the adjacency effect, but it appeared that the "popularity" of a program type was not affected by the program adjacent to it.

Conclusions

The following conclusion may be made in interpretation of the experimental findings: For radio surveys utilizing the personal interview method, with the general adult population or any of the groups isolated and analyzed in this study, using this check list to determine favorite radio program types, there is an ordinal position effect that must be taken into consideration by the researcher.

Microfilm copy of complete manuscript of 185 pages, \$2.31. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-813.

A CRITICAL ANALYSIS AND COMPARISON OF SELECTED 1932 PRESIDENTIAL CAMPAIGN SPEECHES OF HERBERT CLARK HOOVER AND FRANKLIN DELANO ROOSEVELT

(Publication No. 7025)

Nicholas McKinney Cripe, Ph. D.
Northwestern University, 1953

The 1932 campaign is significant to the speech critic because so much emphasis was placed on public address by the major candidates. In this particular campaign Roosevelt delivered some 113 prepared speeches; and President Hoover, recognizing the effectiveness of the Roosevelt campaign speeches, ignored historical tradition, deserted the White House, and became the first President to take to "the stump" to campaign extensively for re-election. No previous occupant of the White House ever campaigned so strenuously to stay in this office.

However, because of their number, it was impossible to make a detailed study of each speech; therefore, this study, which had as its purpose the determining of how these two speakers approached a

similar speech situation, was limited to an analysis and comparison of speeches delivered on similar occasions before like audiences by the two men. To accomplish this end, this study was divided into the following chapters:

Chapter I - Herbert Clark Hoover. The purpose of this chapter was to see Hoover as he actually was and as the voters thought him to be. It was discovered that Hoover, who went from a little Iowa cottage to the White House and from poor orphan boy to millionaire engineer, was just the opposite from the cold, machine-like, humorless individual with little interest in the public welfare that so many voters thought him to be. Actually, he was a warm and intelligent man who was inordinately shy, who disliked people en masse, and who disliked giving a speech in public.

Chapter II - Franklin Delano Roosevelt. The man who was the Democratic nominee in 1932 was a big man physically. Mentally his was an alive and inquisitive mind, one capable of deep concentration and energetic action. Emotionally he was warm and friendly with a sincere regard for people and a delightful sense of humor. He had a way of making people like him. However, about all that most people knew about him in 1932 was that he had a famous name and a fine smile, and that he opposed Hoover.

Chapter III - The United States, 1921-1932. The purpose of this chapter was to highlight such topics as the prosperity of the Twenties, prohibition, tariff laws, and the bonus - events and issues which probably played a role in influencing the thinking and attitudes of the audiences listening to the candidates in 1932.

Chapter IV - The Presidential Campaign of 1932. Here the focus was on the two national conventions, how the campaigns were organized and financed, the issues faced by the two candidates, and how they met or evaded these issues on their speaking tours. This latter section contained a resume of the speeches delivered by the candidates, where they were delivered, when, and to whom.

Chapter V - Preparation and Delivery. Certain conclusions seem evident from this chapter concerning the two speakers. For instance, Roosevelt's speeches were no more "ghost written" in the technical sense of the word than were Hoover's. While Hoover, perhaps because of the intensity of his beliefs, managed to do the best speaking of his career, Roosevelt's superior delivery and style, plus his ability to establish a sympathetic relationship with his audiences, completely overshadowed Hoover's limited ability as a public speaker.

Chapter VI - A critical Analysis and Comparison of Four 1932 Presidential Campaign Speeches of Herbert Hoover and Four of Franklin Roosevelt. The speeches analyzed and compared in this chapter were the Acceptance Speeches, the Detroit Addresses, the Madison Square Garden Addresses, and the final radio speeches of the two candidates. Conclusions that seemingly can be drawn from this chapter are that Roosevelt's style was more simple than Hoover's, and that Roosevelt's adaptation of his speeches to the audience and the occasion was better

than Hoover's. He also seemed to make better use of the factors of invention and arrangement than did Hoover.

Microfilm copy of complete manuscript of 869 pages, \$10.86. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-814.

THE REPRESENTATION OF THE WEST IN AMERICAN DRAMA FROM 1849 TO 1917

(Publication No. 7497)

Stuart Wallace Hyde, Ph. D.
Stanford University, 1954

This dissertation investigates the manner in which the West is represented in American plays written between the gold rush and the first World War. Prior to 1849 only a small number of Western plays were written, while following 1917 most of the dramatic activity devoted to the subject of the West was confined to the motion pictures.

The term "the West" as used in this work refers in general to the geographical area West of the present states of Michigan, Indiana, Kentucky, Tennessee, Mississippi, and Louisiana. The plays selected for the examination take place either in whole or in part in this area, or else feature an important character who is originally from this area.

The dissertation is divided into three chapters. The first chapter is concerned with the major events in the history of the West, the stage histories of the most important plays which were inspired by these events, and the plot outlines of these plays. The second chapter discusses the characters of the Western plays, and includes sections on the following: The heroes of the Western plays; the conception of the Western man; the heroines of the Western plays; the contrast of Eastern and Western heroes and heroines; the villains of the Western plays; the Indian characters; the character of Brigham Young; the Mexican villains; the comic characters of the Western plays; the comic Chinese character; the "dude" or "tenderfoot" character; the "colonel Starbottle" character. The third chapter discusses the ideas in the Western plays, and is divided into the following sections: The development of the democratic principle in the United States and the West; the Western attitude toward law and government; individualism in the West; the Western attitude toward education and the uneducated man; optimism in the West; the West vs. the East.

The conclusions reached in this study indicate that the West as a subject or background of American plays was of considerably more importance in the history of American drama than has previously been supposed. Between 1849 and 1917 at least twelve hundred Western plays were written and are listed in the bibliography of the dissertation. Some of the most popular American plays of that period were set in the West or else made important use of Western characters. Among the authors of the

Western plays could be found almost every major playwright of the period. For these reasons it may be concluded that the Western drama produced more activity among writers and theatre managers and demanded more attention from theatre audiences than the standard works on American drama would lead one to believe.

In general it can be said that the Western drama did not develop as a thing apart from the rest of American dramatic literature. The form of the plays - melodrama - underwent no alteration at the hands of the playwrights who wrote Western plays, and the ideas expressed were largely those which are to be found in non-Western plays of the period, and which can be traced back to the works of such writers, philosophers, and scientists as Montaigne, Rousseau, Locke, Hegel, Kant, Darwin, Huxley, and Marx, among others. New character types and new plot incidents were a contribution of the Western plays, as was a new pride and interest in native American materials. While the Western drama was not entirely different from the non-Western drama of the period, it can be said that, in their search for a native American drama, the playwrights of the nineteenth century found their first, and in many ways their most popular materials in the West. In this respect the West was not so much an influence as it was a discovery.

Microfilm copy of complete manuscript of 501 pages, \$6.26. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-815.

THE CHARACTERIZATION OF THE MALE PROTAGONIST IN SERIOUS AMERICAN DRAMA FROM 1867 TO 1920

(Publication No. 7515)

Willard Welsh, Jr., Ph. D.
Stanford University, 1954

An examination of serious American drama from 1867 to 1920 has revealed a consistent attempt to characterize the protagonist as sympathetic in the eyes of the contemporary audience. To achieve this end, playwrights took the commonly accepted tastes, ideals, and moral attitudes of their day and embodied them in specific character traits and actions. Since tastes and ideals are mutable, certain changes in the depiction of the protagonist have taken place from one era to another. These changes are indicative of an evolving concept of what is admirable in human qualities and conduct. At the same time, some qualities in the hero seem not to have changed; and this fact suggests that certain ethical values may be universal and enduring. The primary purpose of the study is to enumerate and discuss the similarities and diversities in the heroes' delineation from 1867 to 1920. The final objective is to demonstrate the value of analyses of dramatic characterization for the social anthropologist as a guide to the cultural patterns, and especially the moral values, of an age.

The period from 1867 to 1920 was selected for two reasons. Firstly, this development in American dramatic history has an organic unity which justifies its treatment as a separate study. Secondly, the fifty-three-year period is long enough to include substantial cultural changes in American life which offer an opportunity to test whether or not corresponding changes in characterization occurred. To show the changes which took place, the general period was divided into three smaller eras: 1867-1886, 1886-1907, 1907-1920. The limitations of these eras, like those of the general period, were determined neither arbitrarily nor historically but by an examination of the protagonists themselves. Of the many plays surveyed from this period, eighty-nine were available in print or manuscript and met the following qualifications: (1) they were original plays, first produced in the United States; (2) they were serious in nature; (3) they contained a male protagonist.

Characterization in drama is any differentiation of one agent from another. The method of analyzing dramatic characterization used in this study employs six levels of differentiation noted by Hubert C. Heffner. These levels or stages, from the simplest to the most complex, are the following:

1. Physical differentiation.
2. Differentiation on the basis of bent or disposition.
3. Differentiation on the basis of attitude.

4. Differentiation on the basis of emotional pattern.
5. Differentiation on the basis of deliberation.
6. Differentiation on the basis of decision.

Because this system of levels is based upon the development by which character becomes action in the Aristotelian ordering of the parts of drama, it provides not only a classification for the traits of the hero but also a scale by which the degree of characterization can be measured. At the conclusion of each of the three chronological divisions, the distinguishing character traits are summarized in terms of these six levels of differentiation. Each summary includes a list of the important ideas expressed or represented by the heroes and a classification of their major decisions as either expedient or ethical.

In the concluding section of the study, two aims are accomplished. Firstly, a survey of the amount of individualization achieved on the different character levels in all three eras shows where the major emphasis of characterization lay during this period from 1867 to 1920. Secondly, six qualities which have appeared consistently in the depiction of the protagonist are offered as elements which may be essential to the heroic role.

Microfilm copy of complete manuscript of 364 pages, \$4.55. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-816.

ZOOLOGY

THE WHITEFISH, *COREGONUS CLUPEAFORMIS* (MITCHILL), OF NORTHERN LAKE MICHIGAN, WITH SPECIAL REFERENCE TO AGE, GROWTH, AND CERTAIN MORPHOMETRIC CHARACTERS

(Publication No. 7158)

Prentice Alvin Caraway, Ph. D.
Michigan State College, 1951

Data are presented pertaining to age composition, strength of year classes, growth in length and weight, and measurements of several body proportions of whitefish from northern Lake Michigan. Samples were taken of the commercial fisheries during portions of the years 1948, 1949, and 1950, from three principal areas: Big Bay de Noc, Gull Island, and High Island.

Length-frequency distributions arranged according to age show considerably more overlapping of the lengths of fish belonging to different age groups in samples from Gull Island and High Island than among Big Bay de Noc samples.

In the 1950 collections year classes 1945 and 1944 made up slightly over 50 per cent of the Gull Island and High Island samples, while Big Bay de Noc collections showed an especially poor representation by these year classes. The especially

high dominance of the 1943 year class is shown in the Big Bay de Noc collections of 1948 and 1949.

Calculated total lengths for each year of life through 8 years show that an advantage of Big Bay de Noc whitefish over Gull Island and High Island fish increased from 0.7 inches at the end of the first year of life to 1.3 inches and 2.3 inches, respectively, at the end of the eighth year.

Formulae expressing the length-weight relationship of fish from three localities are presented. The weights of the northern Lake Michigan whitefish increased to the following powers of the lengths: Big Bay de Noc, 3.2544; Gull Island, 2.9886; High Island, 2.8166.

Commercial catches were examined for incidence of scars caused by sea lamprey, *Petromyzon marinus*. Tabulation of marked fish on basis of age-groups revealed no fish belonging to age-groups I, II, III, and only 6.4 per cent of age-group IV, with either fresh or healed scars.

The method of analysis of variance, based upon the year classes, is applied to several body proportion measurements of fish from different localities. Four measurements (SL, H, CPL, CPD) taken of fish from four localities and belonging to five different year classes (age-group III to VII) are compared. In general, differences between Gull Island

and High Island fish are not significant, except for some measurements among the young fish (III, IV). Fish from each of these localities differs from the Big Bay de Noc fish at the level of high significance. St. Helena Island fish closely approach those of Big Bay de Noc. Among the Big Bay de Noc samples there are no significant differences. The method of analysis of variance applied to values of the ratios SL/H and CPL/CPD as determined for the several samples reveal no significant differences between fish from any of the localities. Tests of the four measurements and two ratios show that the differences between the sexes of Big Bay de Noc fish are not significant.

Microfilm copy of complete manuscript of 148 pages, \$1.85. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-817.

ANALYSIS OF HYPERTROPHY AND ATROPHY OF DENERVATED SKELETAL MUSCLE

(Publication No. 7202)

Doris Mae Stewart, Ph. D.
University of Washington, 1953

The phenomenon of hypertrophy following denervation of the hemidiaphragm was found to occur in each of the three species studied, the mouse, rat and rabbit. The duration of the hypertrophy period was greater in the mouse than in the rat. In the mouse hypertrophy was still evident in some cases at 56 days after denervation. The hypertrophy period in the rat was over in all cases examined after 18 days. The hypertrophy was of greatest magnitude in the mouse and least in the rabbit suggesting a possible relationship between respiratory rate and the extent of hypertrophy.

To determine whether the increase in weight was due to the formation of new protein direct determinations were made of the total protein nitrogen and of two protein fractions, the connective tissue proteins and the sarcoplasmic proteins. The contractile protein content was determined by difference. For comparison with the increase in protein accompanying another form of skeletal muscle hypertrophy, the phenomenon was induced in the levator ani muscle by testosterone administration. It was characterized by an absolute increase in all three components with no change in concentration of the fractions listed. During the hypertrophy period of the hemidiaphragm a similarly increased protein content occurred which was distributed among the three fractions so that there was no change in concentration of the contractile proteins and only a very slight increase in concentration of the sarcoplasmic proteins at the peak of hypertrophy. The contractile proteins, as quantitatively the largest fraction of the muscle protein, contributed the largest part of the increase in total protein during the hypertrophy phase. Similarly during atrophy a larger portion of the decrease in total protein was due to decrease in contractile proteins.

An attempt was made to produce hypertrophy in the gastrocnemius soleus muscles by rhythmic stretch. Hypertrophy did not occur, but atrophy was definitely retarded by this treatment, and many more experiments will be needed to rule out the possibility of producing hypertrophy with variations of the method. Because atrophy of the hemidiaphragm occurs despite an initial period of hypertrophy, and because of differences found in the work of other authors in the nature of the response to denervation and to immobilization, it was suggested that proper balance of two factors are necessary for normal maintenance of muscle. These are a trophic substance produced by the nerve and the development of intermittent tension, either actively by the muscle fibers or imposed passively by the investigator.

Microfilm copy of complete manuscript of 89 pages, \$1.11. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-818.

EMBRYOLOGY OF THE MOUTHPARTS OF ANOPLURA

(Publication No. 7517)

Joseph Hardie Young, Ph. D.
Stanford University, 1954

This paper deals with the subject of morphological embryology in the head of the hog louse and the human louse, representing thereby a departure from a strictly descriptive embryological treatment. Moreover, the embryonic stages here considered begin with the generalized pre-revolution or segmentation embryo, a stage beyond which most previous work has not gone. The present work traces the history of the head organs, with particular reference to the mouthparts. The difference in approach arises from the availability of accurate facts of the anatomy of the head of the adult hog louse and human louse. Certain conclusions may therefore be set forth:

1. The segmentation embryo of the hog louse is comparable in nearly all respects to that of a generalized insect embryo. It is from this generalized embryo that the highly specialized mouthparts of the adult hog louse develop.
2. Coelomic sacs appear in the labrum, antennae, mandibles, maxillae, and labial appendages. Presumably, the presence of these mesodermal pouches indicates the existence of segmentation, but their absence from a region does not necessarily mean that the region is not a segment. There are other criteria for determining the existence of segmentation.
3. The supraoesophageal ganglion develops independently of the suboesophageal ganglion. The frontal ganglion develops from the dorsal surface of the stomodaeal invagination.
4. Embryonic posterior tentorial pits invaginate into the labial segment during pre-revolution

stages, and disappear following the revolution of the embryo. The tentorium is missing in the adult of the sucking lice.

5. The embryonic labial or head glands and ducts are fully homologous with the salivary glands and ducts of the adult.

6. The hypopharynx is taken to be the region ventral or posterior to the point of stomodaeal invagination, possibly including the venter of the mandibles.

7. The large ventral structure heretofore referred to as the hypopharynx in previous embryological studies is here termed the maxillary lobe. It arises as a paired development of the maxillary segment venter.

8. The epidermal cells do not appear to secrete cuticular material; this substance develops as a differentiation product of the epidermal cells.

9. The unique mouthparts of the hog louse arise during the revolution stages. At this time, and with singular rapidity, the generalized embryo is molded into a distinctly louse-like form.

10. The structures called the mandibular vestiges by Ferris (1951) are found to be mandibular in origin. However, the mandibular appendages also give rise to a sclerotized tube, the food channel, which lies ventral to the palatum and is fused to it posteriorly.

11. The maxillary appendages form a pair of sclerotized rods, here named the maxillary guides,

which lie at the lateral sides of the common cibarial-trophic cavity, at a point at which the trophic sac is branching from the cibarium. The maxillary lobe develops the maxillary stylets.

12. The salivary stylet is laid down by the true opening of the common salivary duct as it recedes into the head.

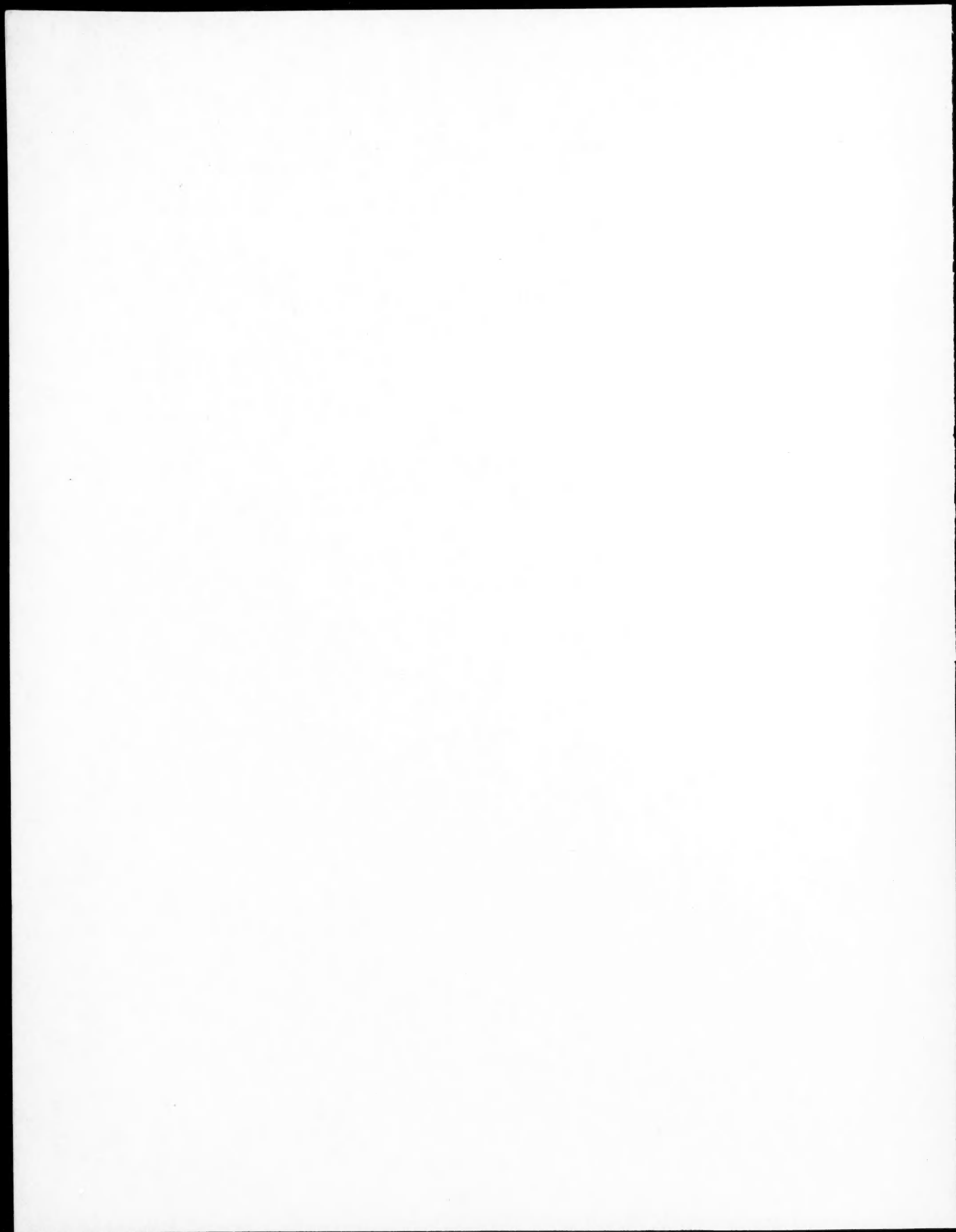
13. The labial stylet arises from a lobe which is separated from the dorsal surface of the labium.

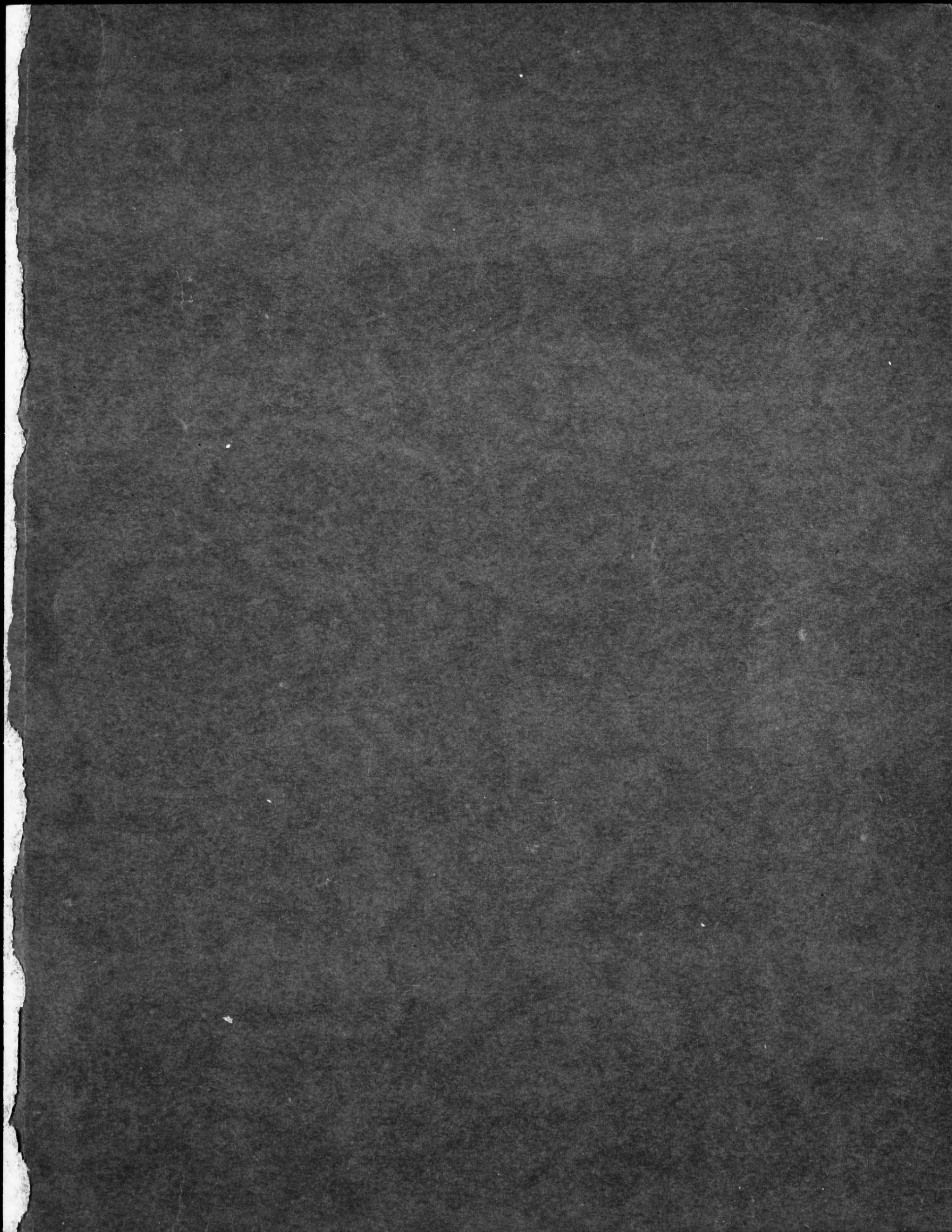
14. The obturaculum, or neck plug, appears to develop from the differentiation products of the haemocoelic fluid and consists of a connective tissue-like substance.

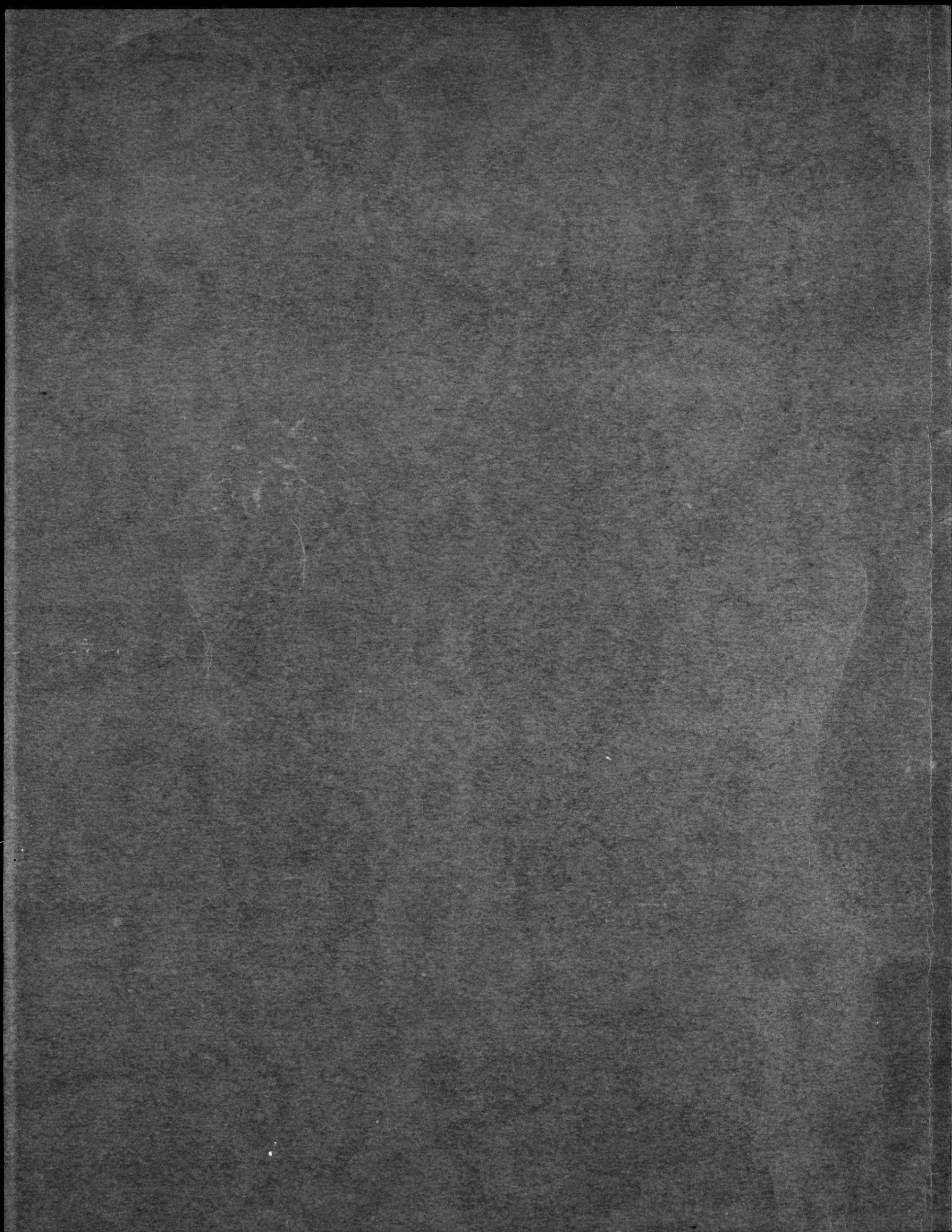
15. The egg burster, a device produced by the embryo to aid in its escape from the egg, is described anatomically and embryologically. It is a specialization of the embryonic cuticle and consists of a plate on the surface of the head which is connected by a pair of arms to an element seated in the cibarium. It is left behind in the egg at the time of hatching.

In sum, the present embryological contribution confirms on most points the morphological work of Ferris and Stojanovich (1951) on the head of the adult hog louse, and in general differs with the findings of previous embryologists who have studied the sucking lice.

Microfilm copy of complete manuscript of 51 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA54-819.







DISSERTATION ABSTRACTS

Volume XIV, No. 4

1954